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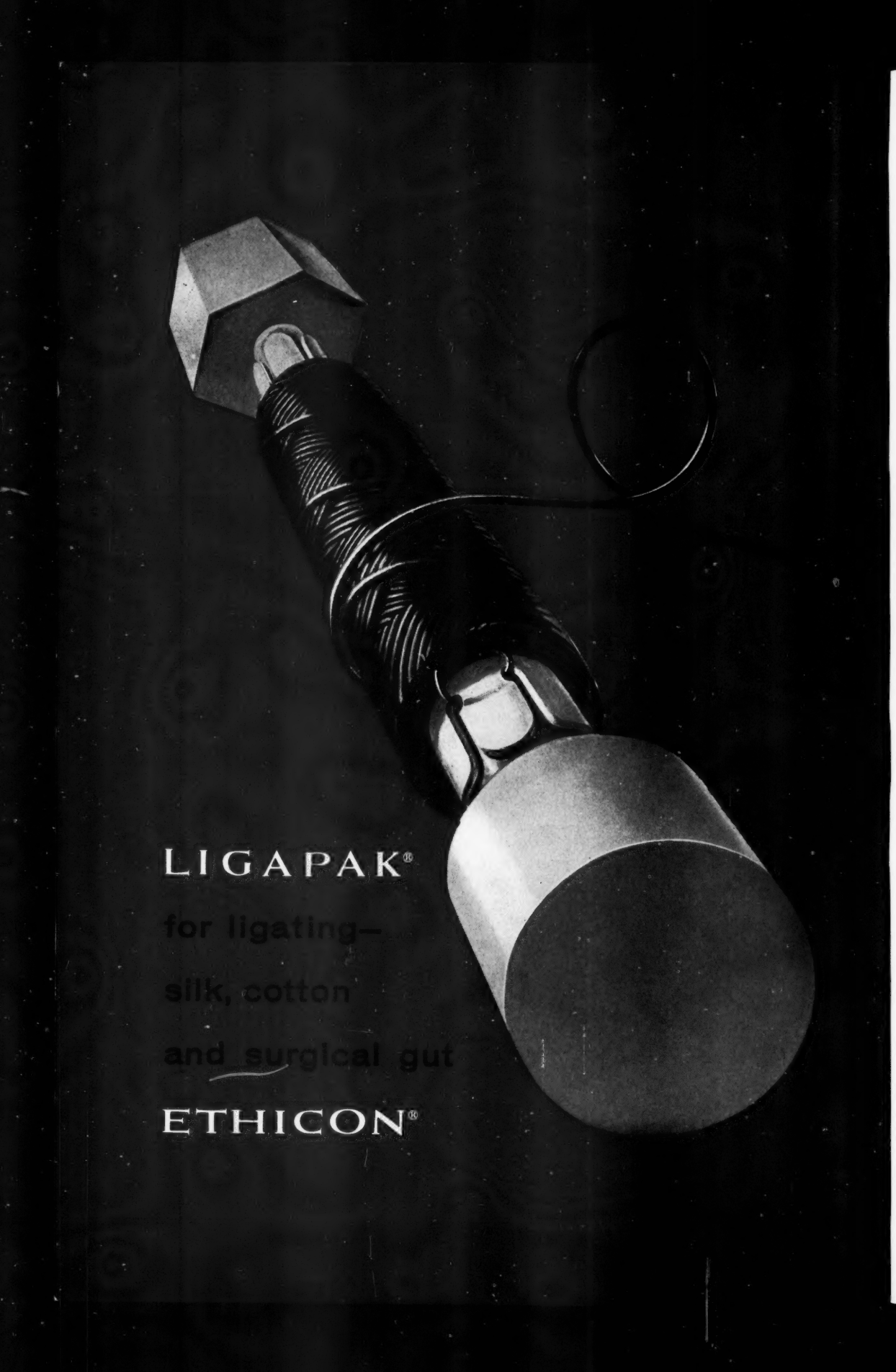
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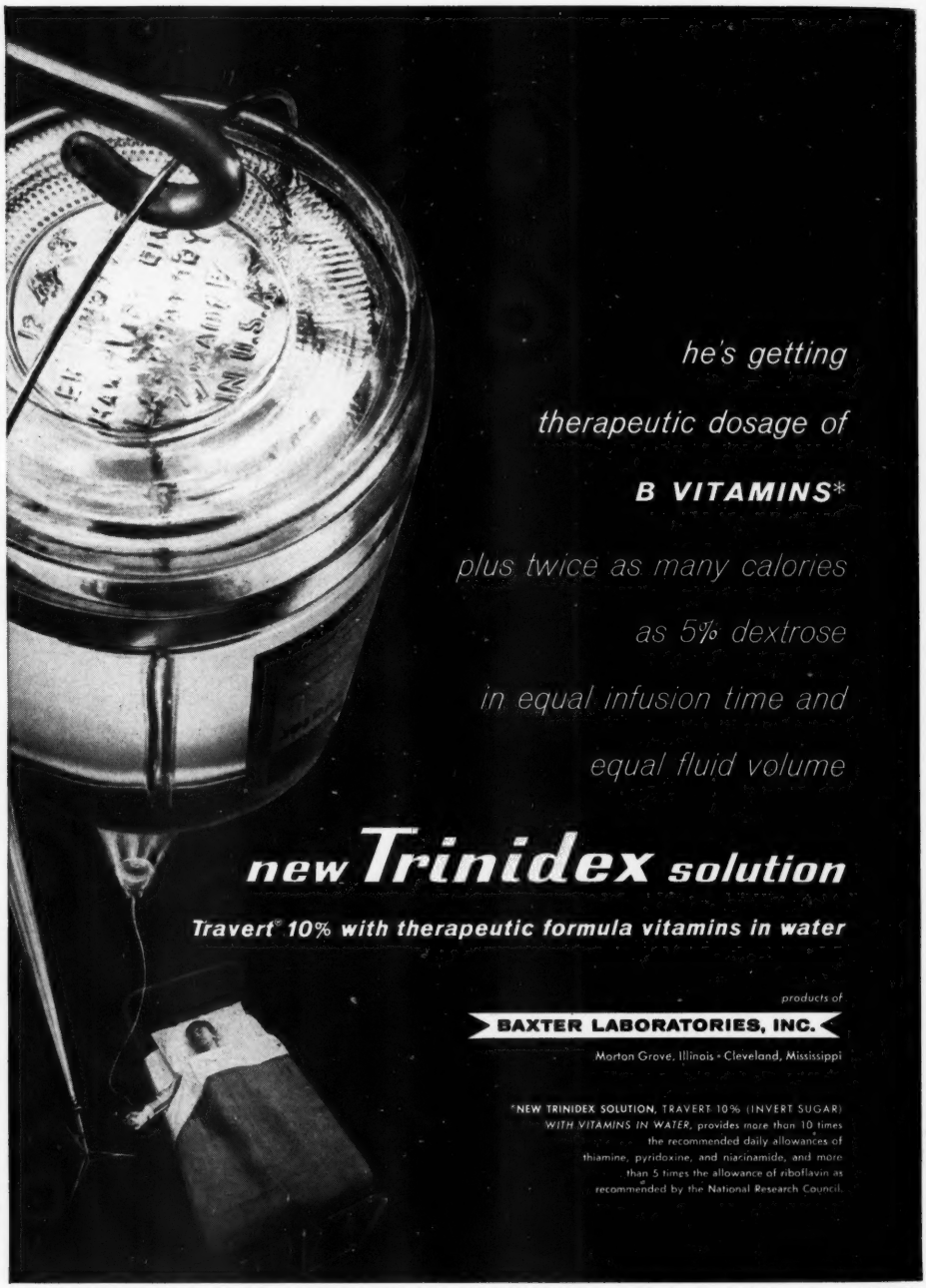
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TOXEMIA OF PREGNANCY AT THE CHARITY HOSPITAL IN NEW ORLEANS

JAMES HENRY FERGUSON, M.D., F.A.C.S., Miami, Florida, and
HENRY K. MILLER, M.D., Baton Rouge, Louisiana

MANY NEW ORLEANIANS have been asked, "What is toxemia of pregnancy like at the Charity Hospital? You have more deliveries than any other hospital in the United States and you are reputed to have so much toxemia. How much do you really have? Is toxemia frequent because you have such a large Negro population? Do many of these women have chronic hypertensive disease? Is the fetal loss from toxemia high? How many of these patients do you section?"

The present article attempts to define the problem of toxemia of pregnancy at the Charity Hospital and to answer the above questions. To accomplish this the authors personally reviewed the hospital records of all of the women who were delivered on the Tulane Service of the Charity Hospital in 1 calendar year, 1950. With the use of rigid definitions, we selected the patients who had toxemia and grouped them according to their type of toxemia. The hospital records of the babies born to these mothers were also examined. A number of important data on the course of pregnancy and fetal outcome were collected and analyzed. This afforded an opportunity to compare our experience with that of other hospitals, to evaluate our treatment and to provide base lines for current and contemplated research.

The investigation was started in early 1952, and the year 1950 was selected for no other reason than that it was the most recently completed calendar year which allowed sufficient time to assume that hypertension would persist indefinitely. There is no reason to doubt that 1950 is a representative year.

The patients studied in this report constitute a fair sample of the hospital's patients. The Tulane Service gives maternity care to approximately 40 per cent of the patients delivered in the hospital, and there is no bias in the selection of patients for the 3 services of the hospital.

In 1950 the number of mothers who were delivered on the Tulane Service was 3,899. The hospital records of 4 mothers and of 4 babies of toxemic mothers, all unrelated, could not be found. We verified that these 4

From the Department of Obstetrics and Gynecology, School of Medicine, Tulane University, and the Charity Hospital of Louisiana at New Orleans.
Huldah Bancroft, Ph.D., Professor of Biostatics, Tulane University, aided in designing and interpreting this survey.

mothers were discharged alive from the hospital.

A 1 year record may introduce some sampling error and where this is possible, restraint will have to be used in drawing conclusions. For example, the incidence and outcome of comparatively unusual cases, like abruptio placenta, may be awry in a period of 1 year. However, a 1 year sample would be sufficient to make valid conclusions on the frequency of the various types of toxemia, perinatal mortality, antepartum care, age, parity, residence, and birth weights.

BACKGROUND OF THE PATIENTS

The patients cared for at the Charity Hospital in New Orleans are drawn from the poorer people of the State of Louisiana. Financial eligibility for admission is determined on an individual basis. Couples with an expected child or 1 child must not have an income in excess of 175 dollars a month.

In 1950, 82 per cent of all the women delivered on the Tulane Service were Negroes. Approximately 65 per cent of the births at the hospital were to mothers from New Orleans, the remainder coming from other parts of the state. The percentages of white and Negro toxemic women with residence outside of New Orleans were 53 per cent and 45 per cent, respectively. These figures may indicate that there is no decided tendency for women of a particular race to come to the Charity Hospital from outside of New Orleans because of this complication.

The diets of the women attending our antepartum clinics have been found by Ferguson and Hinson to be about the poorest recorded in the United States (13, 16). Only 4 per cent of 209 women were eating the recommended daily allowance of 85 grams of protein. In a random sampling of 24 hour food consumption, 45 per cent of the women had had no milk, 31 per cent no meat, 66 per cent no egg, and 28 per cent no vegetable or fruit.

Attendance at clinic is not good. Nineteen per cent of the toxemic women described in this article had no antepartum care and 20 per cent made only 1 to 4 antepartum visits. Thirty-three per cent of the toxemic mothers did not return for a postpartum visit.

CLASSIFICATION OF TOXEMIA

In this report the terms "toxemia of pregnancy," "toxemia," and "toxemic" will have their broadest connotation, embracing all of the hypertensive and albuminuric disorders of pregnancy. "Pre-eclampsia" and "pre-eclamptic" will be used only in the sense defined later. Each case of toxemia is assigned to one of the following subgroups: (1) pre-eclampsia; (2) eclampsia; (3) chronic hypertensive disease; (4) chronic hypertensive disease with superimposed pre-eclampsia; (5) unclassified.

The reported incidence of toxemia in a hospital depends on who writes the diagnosis on the face sheet of the hospital chart and what he uses as criteria of diagnosis. For this study the following definitions were uniformly used by the authors for the evaluation of each patient's chart and for the determination of the diagnosis. The definitions were patterned after those in the Williams-Eastman textbook because it was used by the Tulane medical students. The classification adopted in 1952 by the subcommittee of the American Committee on Maternal Welfare was not available when we started this study.

DEFINITIONS

Hypertension. Hypertension is the observation of a systolic blood pressure of 140 millimeters of mercury or above, or a diastolic blood pressure of 90 millimeters of mercury or above. The elevation must be found on at least 2 occasions 24 or more hours apart.

Albuminuria. A patient has albuminuria when there is a definite positive test for protein with a catheter specimen of urine that is devoid of pus and blood.

Pre-eclampsia. Pre-eclampsia is defined as hypertension or albuminuria that develops after the twenty-fourth week of pregnancy and disappears after delivery.

TABLE I.—TOXEMIA OF PREGNANCY AT CHARITY HOSPITAL OF LOUISIANA IN NEW ORLEANS, TULANE SERVICE, 1950

Diagnosis	No. of cases	Incidence on service Per cent	Per cent of toxemic patients	Live births	Stillbirths No.	Stillbirths Per cent	Neonatal deaths	Prematures (live)
Toxemia (all cases)	736	19	—	709	49	6.5	21	109
Pre-eclampsia	349	9	47.4	349	13	3.6	4	34
Eclampsia	10	0.3	1.4	13	1	—	5	8
Chronic hypertensive disease	180	4.6	24.2	167	19	10.6	5	30
Chronic hypertensive disease with superimposed pre-eclampsia	167	4.3	22.7	158	14	8.4	3	29
Unclassified	30	0.8	4.1	28	2	—	1	8

Chronic hypertensive disease. Patients with chronic hypertensive disease are those in whom hypertension appears before the twenty-fourth week of gestation and persists indefinitely after delivery.

Chronic hypertensive disease with superimposed pre-eclampsia. Patients with chronic hypertensive disease who have superimposed pre-eclampsia are those who develop further elevation of systolic blood pressure of 30 or more millimeters of mercury, further elevation of the diastolic pressure of 15 or more millimeters of mercury, or albuminuria.

Difficulties of classification. Many unquestionable cases of toxemia were difficult to classify because of an insufficient number of observations on the patients. This was usually due to the patients' laxity in participating in antepartum care and in returning for the postpartum visit. Women referred to the hospital were often not accompanied by a case record. Even when the patients' records furnished what should have been sufficient data, classification was sometimes difficult because the cases did not fit well into the classification used here (nor the classification formulated by the American Committee on Maternal Welfare). Perplexing hypertension ensembles which recurred with some regularity were: (a) hypertension that began after the twenty-fourth week of pregnancy and persisted indefinitely, (b) hypertension in several pregnancies, and blood pressure normal in the 1950 pregnancy until the end of pregnancy, when hypertension reappeared, (c) hypertension that appeared late in two or more pregnancies and late in the 1950 pregnancy but was inconsistently found in the intervals between pregnancies, (d) hypertension at the postpartum visit and only then, (Meyer has described the local experience with this phenomenon and Kaltreider and Gilbert the experience elsewhere), (e) hypertension that began before the twenty-fourth week of pregnancy and was not present at the postpartum visit or in a subsequent pregnancy, (f) hypertension in 2, 3, or more pregnancies and at postpartum visits, but did not appear in the 1950 pregnancy. (a), (b), and (c) are considered in this report to have chronic hypertensive disease. So frequently was it difficult to decide which were chronic hypertensive diseases and which was pre-eclampsia that we were tempted to suggest that they were not two diseases but one.

Albuminuria in labor. There was no attempt made to separate cases in which albuminuria was found only during labor from those in which it was discovered at other times. Ideally this should be done. The observation that labor can cause transient albuminuria without other evidence of toxemia has been made variously. Winnifred Seegars examined catheter specimens of 50 nontoxic women in labor at the Sara Mayo Hospital, New Orleans, and found that 16 gave a positive test for protein. Douglas remarked that at the New York Lying-in Hospital protein was observed in the urine of the majority of normal women at the time of delivery.

INCIDENCE OF TOXEMIA

Seven hundred and thirty-six mothers on the Tulane Obstetric Service had toxemia of pregnancy in 1950. This is an incidence of

19 per cent. A separation of these cases into the various subgroups of toxemia is given in Table I and the subgroups are individually considered later in this paper. There was 1 maternal death.

It is impossible to compare accurately our incidence of toxemia with those of other hospitals because of the differences in definitions and methods of reporting. Comparisons of the frequency of toxemia in the local populations are even less reliable because of dissimilarities in the service that each reporting hospital performs in its community, the differing eligibility of patients for hospital admittance, varying regional dependence as a referral point for seriously ill patients, and other selective factors that would not be recognized by the casual reader. These shortcomings should be kept in mind as we examine the frequency with which some hospitals have recently been seeing toxemia. By any standard the Charity Hospital patients have a good deal of toxemia. The figure of 25.2 per cent for nonconvulsive toxemia at the "University of Tennessee-Gaston, 1946–1949" (given by Dieckmann) is the only higher incidence we can find. Wellen (28) reported an incidence of 5.17 per cent of hypertensive conditions in pregnancy at the Bellevue Hospital in a 15 year period ending in 1950. Lundgren reported that the incidence of toxemia in 1950 at the Margaret Hague Maternity Hospital was 11.9 per cent. From the ward service of the Sloane Hospital for Women, 1931 to 1950, the toxemia rate was 12.2 per cent. In 1947 to 1949, 3.1 per cent of the parturients were toxic at the Royal Victoria Montreal Maternity Hospital.

The high rate of toxemia at the Charity Hospital is probably not because of its large colored census. In 1950, 18 per cent of the women delivered on the Tulane Service were of the white race and 17 per cent of the toxemic mothers were white. The proportion of the women in the pre-eclampsia-eclampsia groups that were white was 21 per cent; 12 per cent of the chronic hypertensive women were white.

This investigation provided a unique opportunity to measure the incidence of toxemia, and each of its components, in a population. In 1950, 89 per cent of all the Negro babies born in New Orleans to mothers with residences in New Orleans were born at the Charity Hospital. This is a relatively high proportion of all the Negro babies born in New Orleans. It has previously been stated that the mothers on the Tulane Service are an unbiased sample of the mothers delivered at the hospital and should be considered adequate for the estimation of the frequency of toxemia in the Negro population. The residence and race of each mother were recorded in this survey and from these data it is estimated that approximately 19 per cent of the New Orleans Negro mothers must have toxemia.

PRE-ECLAMPSIA

The number of mothers who had pre-eclampsia was 349. They represented 9 per cent of the entire service and 47 per cent of the toxemic patients. Forty-seven per cent of these pre-eclamptics were primigravidas and 32 per cent were 19 years old or younger. The incidence of pre-eclampsia among all the Negro women on the service was 8.6 per cent.

This incidence of pre-eclampsia would have been much higher if, instead of the requirement that hypertension be observed on 2 occasions 24 or more hours apart, we had used the American Committee on Maternal Welfare's classification, which utilizes a 6 hour interval. If that committee's criteria of edema and weight gain had been used to diagnose pre-eclampsia, a very much greater number of women would have to be considered pre-eclamptic. Our insistence that albuminuria be claimed only on a catheter specimen devoid of pus and blood reduced the number of patients diagnosed as pre-eclamptic. The diagnosis was based on albuminuria alone in 5 cases.

To make certain that our collection of pre-eclamptics was not heavily weighted with women who had minor hypertension

those women who had minimal blood pressure elevation were sorted. There were 61 women, 17 per cent of all the pre-eclamptics, whose systolic blood pressure was always recorded as below 146 millimeters of mercury and whose diastolic blood pressure was always below 96 millimeters of mercury. These women had no perinatal fetal deaths. Some of our eclampsia appears in women with these false security engendering levels of hypertension; we will have to continue treating with vigor these "mild" cases.

When we compared the monthly incidences of pre-eclampsia in 1950 we saw no seasonal trend except for an unremarkable tendency to be more frequent in January through May. The monthly rate ranged from a low of 4.3 per cent in November (the month in which most eclampsia appeared!) to 12.2 per cent in March.

"Severe" pre-eclampsia is frequently defined as pre-eclampsia marked by a systolic blood pressure of 160 millimeters of mercury or over, or a diastolic blood pressure of 110 millimeters of mercury or over. The same definition will be used in this essay. One hundred and seventy-three women, which was 50 per cent of our pre-eclamptics, qualified for this category. They provided 10 of the 13 stillborn babies that the pre-eclamptic women had.

It has been said that modern antepartum care has not reduced the frequency of pre-eclampsia but it has curbed severe pre-eclampsia and eclampsia. This has also been our impression. Wellen claimed that at the Bellevue Hospital antepartum care did not influence the incidence of severe pre-eclampsia (27). For each toxemic woman in this Charity Hospital study, the week she began antepartum care and the number of her visits were recorded. Similar data are not available from any large group of normal patients at this hospital for comparison. An attempt was made with this information to show that early institution of antepartum care and a greater number of visits increased the likelihood of the mild form of this complication rather than the severe form. The week in which antepartum care began was plotted against the number of visits and many comparisons made between the patients with mild pre-eclampsia and those with severe pre-eclampsia. As far as these data could demonstrate there were no differences between the mild and the severe pre-eclamptics that were statistically significant. Because of the numerous variables involved we do not believe that these observations disprove that good antepartum care prevents severe pre-eclampsia.

Seventy-six of the women with pre-eclampsia were hospitalized before labor for a total of 410 hospital days, an average of 5.4 days per hospitalized pre-eclamptic patient.

Fifteen of the pre-eclamptic women (4 per cent) were delivered by cesarean section, only 4 of those because of the pre-eclampsia.

These pre-eclamptic mothers had only 13 stillbirths (3.6 per cent) and 4 babies that expired in the neonatal period. This is a perinatal death rate of 4.8 per cent, or 49 per thousand live births.

In 1950 our management of pre-eclampsia and other forms of toxemia was generally conservative. The low section rate speaks for itself. Immediate hospitalization on the appearance of pre-eclampsia was desired but was an ideal frequently unattained. In the hospital bedrest and sedation were the mainstays of therapy; phenobarbital was the drug used most often, while morphine or meperidine were used when greater sedation was indicated. Ammonium chloride and 10 per cent dextrose infusions were close to routine measures. Mercurial diuretics were used infrequently then and on an experimental basis. Hypotensor drugs were untried.

The choice of induction of labor was influenced by response to treatment, severity of the pre-eclampsia, week of gestation, size of the fetus, distance from home to hospital, tractability of the patient and favorableness of the cervix. Seven per cent of the pre-eclamptics had induced labors that could be recognized by reading their charts and the most frequent method was pitocin infusion.

Stimulation of the uterus by "stripping" of the membranes during vaginal examination was widely practiced. Local anesthesia for delivery was frequently used and general anesthesia comparatively little.

ECLAMPSIA

There were 10 cases of eclampsia on the Tulane Service in 1950. These patients formed 0.26 per cent of all the patients delivered on the service and 1.4 per cent of the toxemic patients. Two of these patients had no antepartum care and 1 had been attended by an outside practitioner. Only 1 eclamptic had made more than 1 antepartum visit. Half of the eclamptics lived outside of New Orleans.

Youth predominated in this group. Only 1 was over 30 years of age. All were Negroes. Seven were primigravidas. Our convulsive toxemia showed some tendency to be grouped together by month. Four cases appeared in November, 2 in September, and 2 in March.

One patient was delivered by cesarean section. There was only 1 stillborn and that infant was born at home without an attendant. The patient was transferred to the hospital after delivery and had a postpartum convulsion. She had had no antepartum care. One mother had twins that survived and another had quintuplets that all died in the neonatal period. There were 3 premature babies among the single births and all survived; 1 was of less than 28 weeks' gestation.

The treatment of eclampsia followed closely that of pre-eclampsia. No unusual techniques were used until tracheotomy was introduced in November 1950, for the eclamptic with respiratory embarrassment. It was used in one of these patients and has been increasingly used since.

CHRONIC HYPERTENSIVE DISEASE

There were 347 women with chronic hypertensive disease delivered on the Tulane Service in 1950. This number constituted 47 per cent of the toxemic patients and 9 per cent of all the patients delivered in that year. Thus the Tulane experience was composed of almost exactly the same number of women with chronic hypertensive disease as with pre-eclampsia. Eighty-eight per cent of the women with this persistent hypertension were Negroes and they formed 9.5 per cent of all the Negro women delivered on the service. Of the 347 women with chronic hypertensive disease, 167 (48 per cent) had superimposed pre-eclampsia as described in "Definitions." The women with and those without superimposed pre-eclampsia are discussed jointly in this section and will be considered separately in the two succeeding subsections.

As anticipated, these women were older parturients. Forty-six per cent were 30 years of age or over and 7 per cent were 40 years or over. Nevertheless, chronic hypertensive disease proved to be a disease not exclusively of older nor of multiparous women. Forty-eight women were pregnant for the first time and 29 were less than 20 years of age.

The women with a chronic hypertension background provided a formidable portion of the stillbirths born to toxemic mothers, specifically 33 stillbirths or 70 per cent of all the dead born babies. However, the effect of a chronic hypertensive condition on our prospects of a live baby were not as pessimistic as others have found nor was the stillbirth rate adversely affected by the superimposition of pre-eclampsia.

Due to their small number these cases cannot validly be used to test the thesis that it is better, from the viewpoint of fetal salvage, to induce labor rather than to wait for a spontaneous onset. It is impossible to learn from the patients' records how many had their date of delivery advanced by vigorous loosenings of the membranes during vaginal examinations. Furthermore, as would be expected, the patients with the greatest hypertension, the most intractable albuminuria, and the poorest fetal survival record were in general the ones selected for induction. Thirty-six patients with chronic hypertensive disease (17 of them with superimposed pre-eclampsia) were induced by one

of the more overt methods and they delivered 7 stillborns. The mothers of 6 of these 7 stillborns also had abruptio, so possibly the abruptio was the indication for induction rather than the hypertensive disease.

Conservatism ruled in the management of chronic hypertensive disease. Only 1.7 per cent of all the chronic hypertensive women had cesarean section primarily because of the hypertension. The Negro chronic hypertensives who availed themselves of antepartum care were seen in a special toxemia clinic because of the unwieldiness of the large regular clinics. The conduct of this clinic has been described by one of us (10). No therapeutic abortion could be found in the records. Hospitalization was the rule when pre-eclampsia appeared and the hospital management was as described under "Pre-eclampsia."

Without superimposed pre-eclampsia. There were 180 women who had chronic hypertensive disease and who avoided the superimposition of pre-eclampsia. This was 24 per cent of all the toxemic mothers and 52 per cent of the chronically hypertensive women.

To learn if these 180 patients included many with a minimal blood pressure elevation we separated all women whose systolic blood pressure throughout this pregnancy was below 146 millimeters of mercury and the diastolic pressure below 96 millimeters of mercury. There were 30 such cases. It is worth noting that in this group of 30 women with "mild" hypertension there were 5 perinatal fetal deaths.

Many of the women in this category had had toxemia of pregnancy before: 27 once before, 27 twice, 14 thrice, and 9 had it 4 or more times. With complete records of the patients' past experiences these figures would be higher. Many had been attended previously by midwives and their blood pressures had been observed only recently in life. Needless to say, no meaningful observations could be made on the frequency of the various types of toxemia that they had had in earlier pregnancies.

Eleven of these women were delivered by cesarean section, only 2 of them directly because of the hypertension.

This group provided 19 dead born infants, an incidence of 11 per cent; 11 of these infants weighed 2,500 grams or less. There were 22 liveborn premature infants, 4 of whom had neonatal deaths; 3 of the survivors weighed less than 1,000 grams at birth. One mature baby died in the neonatal period.

With superimposed pre-eclampsia. There were 167 women with chronic hypertensive disease and superimposed pre-eclampsia. Thus 48 per cent of the women with chronic hypertensive disease had this augmentation of their difficulties. Our patients with chronic hypertensive disease had a chance of developing pre-eclampsia which was not quite 5 times greater than that of our normotensive women in 1950. Jones reported from the Providence Lying-in Hospital that patients with essential hypertension had 14 times the usual expectancy of eclampsia. At the Margaret Hague Maternity Hospital Lundgren, McCaw, and Burnett and their associates found that 24 per cent of the chronic hypertensive women had pre-eclampsia in 1950, while one-third and one-fifth of them had it in 1949 and 1948.

Sixty-six of the women in this group had been hospitalized before labor because of their pre-eclampsia for a total of 608 days, an average of 9.2 days per patient.

Using the previously cited qualifications, the condition of only 26 of these women (16 per cent) could escape being called "severe."

As in the other group of women with chronic hypertensive disease, documented previous episodes of toxemia were common despite incomplete past histories. Thirty-one women were known to have had toxemia once before, 20 twice, 15 thrice, and 10 had it 4 or more times.

These patients showed no distinctive monthly trend in the onset of pre-eclampsia.

The blood pressure standard for this diagnosis could be more sharply defined. In its

present form it allows considerable latitude on the part of the man who determines the diagnosis in each case. In this survey any further elevation of the prescribed magnitude (30 systolic or 15 diastolic) that occurred in the latter weeks of pregnancy satisfied the blood pressure qualification. This highest blood pressure was compared to the highest obtained earlier in this pregnancy. The physiologic lowering of the blood pressure in mid-pregnancy served to confuse. Fifty-nine of these 167 women had albuminuria and allowed no equivocation. Because the separation of chronic hypertensive disease and that disease with superimposed pre-eclampsia was difficult in so many instances we were made freshly aware that the borderline between chronic hypertensive disease and pre-eclampsia was indistinct enough to challenge its existence.

The patients with chronic hypertensive disease and those with chronic hypertensive disease plus pre-eclampsia were compared to see if any prophylactic effect of antepartum care could be observed. The contrast was made by means of data on the week of gestation that antepartum care was started and on the number of visits, exactly as was done in the analysis of mild pre-eclampsia and severe pre-eclampsia. These aspects of antepartum care could not be demonstrated to have influenced whether or not a patient with chronic hypertensive disease acquired pre-eclampsia. Again, the variables involved are numerous, and we do not claim that antepartum care is unimportant in the worsening of this hypertensive syndrome.

Two select groups of women with chronic hypertensive disease at the Charity Hospital clinics are available for comparison with the 1950 patients. Twenty-eight women who as controls received a placebo in a clinical experiment began antepartum care by at least the twentieth week of pregnancy and were usually seen weekly in a special clinic. They had a 37 per cent incidence of superimposed pre-eclampsia (9). A similar control group of 139 chronic hypertensive women who received unusually close attention had 27 per cent of its members develop a superimposition of pre-eclampsia (12). The lower incidence of pre-eclampsia in these groups suggests that careful antepartum treatment is an important factor in curbing this complication.

Thirteen women had cesarean section, 4 of them primarily because of toxemia.

There were 14 stillbirths, an 8 per cent incidence in the subgroup, of which 2 were plural births and 3 were premature. In this classification of toxemia our fetal survival record continues to compare favorably with that reported elsewhere. In the Margaret Hague Maternity Hospital the superimposition of this acute illness on chronic hypertensive disease raised the fetal loss from 18.5 per cent to 50 per cent, according to Cosgrove and Chesley. Contrary to the usual experience, our stillbirth and perinatal death rates were slightly less in the chronic hypertensive women who had superimposition of pre-eclampsia. Why this should be so can only be guessed. Possibly the appearance of pre-eclampsia spurred the decision to terminate pregnancy rather than to allow it to go through the perilous later weeks of a hypertensive pregnancy. The slightly higher percentage of cesarean section, induced labors, and premature babies in the superimposed pre-eclampsia group suggests this is what happened.

UNCLASSIFIED

Thirty women are placed in an unclassified group because they undoubtedly had toxemia, and we cannot accurately catalogue them at this time. The inability to classify the cases is usually due to nonappearance except for delivery, desertion, or referral without a case history. No woman included here, or elsewhere in this report, had the symptom complex frequently termed "chronic nephritis." There were no cases of glomerulonephritis. Section was performed in 3 cases, in 1 of them for toxemia. The only noteworthy observation on the babies is that there were 2 stillborns, 10 premature births, and 1 neonatal death.

FETAL OUTCOME

These 736 toxemic mothers had 709 live born babies of which 45 were plural births. Not distinguishing live born and dead born, there were 22 sets of twins and 1 set of quintuplets.

There were 49 stillbirths including plural births and babies of all weights. This is 6.5 per cent of all the babies delivered of toxemic mothers and a stillbirth rate of 69.1 per thousand live births. This is almost treble that of the hospital rate. In all of our figures on fetal outcome embellishing corrections are not made for any factor. All infants born in the delivery unit or en route to it are included. It will be noted simply that these 49 stillbirths included 29 premature, 4 plural births, and 7 infants of less than 28 weeks' gestation. Patients of 20 weeks' gestation or over are admitted to the delivery unit; the remainder of the pregnant women go to a gynecology ward. The stillbirth rates for the service or the hospital in 1950 are not available for comparison. The most pertinent figure that has been computed is the stillbirth rate of 27.7 per thousand live births at the Charity Hospital for the year ending June 30, 1953.

The analysis of fetal survival in each of the subgroups is given in the paragraphs dealing with them and in Table I. Chronic hypertensive disease was more lethal for the fetus than the acute forms of toxemia. The mothers with pre-eclampsia-eclampsia had 23 perinatal fetal deaths, an incidence of 6 per cent. The mothers with chronic hypertensive disease, both with and without superimposed pre-eclampsia, had 44 perinatal fetal deaths, or 13 per cent. The probability of this difference occurring by chance is less than 1 in 1,000. To test further the peril to the fetus from chronic hypertensive disease, the perinatal fetal mortality of pre-eclampsia-eclampsia can be compared to the 15 per cent perinatal mortality rate of chronic hypertensive disease without superimposed pre-eclampsia. Again, the probability of this difference occurring by chance is less than 1 in 1,000.

Our stillbirth rate of 6.5 per cent and perinatal rate of 9.2 per cent compare well with figures published from other hospitals. Keeping in mind the lack of uniform standards, we can note that Cosgrove and Chesley announced an infant death rate of about 50 per cent in superimposed pre-eclampsia (ours, 8.2 per cent). At the Margaret Hague Maternity Hospital in 1950 the stillbirth rate for toxemia was 15 per cent. Wellen (27) reported an infant mortality of 12.4 per cent in specific hypertensive disease and 15.3 per cent in essential hypertension at the Bellevue Hospital. Jones recorded that at the Providence Lying-in Hospital mild hypertensive disease with superimposed pre-eclampsia had a perinatal mortality of 21.9 per cent. From the Liverpool Maternity Hospital, Hamilton and his associates quoted a perinatal mortality rate of 19.7 per cent for pre-eclampsia. Agüero reported from Caracas a death rate of 20 per cent, 4 times that of the hospital. At the Royal Victoria Montreal Maternity Hospital, Hendelman and Philpott had an uncorrected fetal mortality of 43 per cent in severe pre-eclampsia and 5.3 per cent in mild pre-eclampsia. The total fetal loss with nonconvulsive toxemia at the Chicago Lying-in Hospital (1940–1950) was reported by Dieckmann as 7 per cent (7). A more complete record of the fate of the fetus in toxemia can be found in a paper of Taylor and associates; we appear to have better results than are generally being reported.

Prematurity. A premature infant is defined here as one with a birth weight of 2,500 grams or less. These 736 toxemic mothers had 109 live prematures. This is an incidence of prematurity, as usually computed, of 15 per cent. There were also 29 dead born premature babies. The incidence of prematurity among all the mothers on the Tulane Service or in the entire hospital in that year is not available for comparison. The most germane figure at hand is the 14 per cent incidence of prematurity for the hospital in 1952 to 1953. These two 12 month spans should be comparable. Thus it seems that toxemia cannot account for the high incidence of prematurity.

The number of premature babies produced in each classification of toxemia is given in Table I. The chronically hypertensive mothers had 59 premature babies and the almost equal size pre-eclampsia-eclampsia group had 42 premature babies.

Six of these premature infants resulted from cesarean sections done because of toxemia and 18 prematures were born following induced labors. The inability to say exactly how many had induced labors has already been explained. Twenty-one of the babies born alive weighed 1,500 grams or less and 13 weighed 1,000 grams or less. Among the total of 70 stillborns and neonatal deaths there were 44 prematures.

Neonatal deaths. All infants dying within 30 days of birth are here considered neonatal deaths. There were 21 neonatal deaths of infants born to these toxemic mothers. This is a neonatal death rate of 29.6 per thousand live births. The only figure at hand for comparison is the hospital rate of 23.4 per thousand live births in 1952 to 1953. Fifteen of the 1950 deaths occurred in premature infants, 5 of whom were under 1,000 grams at birth. The number of babies born to the mothers with each toxemia diagnosis were: pre-eclampsia, 4; eclampsia, 5 (quintuplets); chronic hypertensive disease, 8; chronic hypertensive disease with superimposed pre-eclampsia, 3; unclassified, 1.

As in other hospitals our follow-up on neonatal survival is not complete. Healthy mothers and babies are usually discharged on the second or third postpartum day. A good number of the babies are brought back to this hospital for subsequent care for the same reasons that brought the mother to the hospital so surveillance during the neonatal time is reasonably good.

Malformations. Among the 740 live and dead born babies there were 13 considered to have major anomalies, an incidence of 1.7 per cent. There was no remarkable distribution of the cases among the various types of toxemia. Although we do not have a figure for the general incidence of anomalies in the hospital, our percentage for babies of toxemic mothers does not seem to support the concern of de Watteville and others over a meaningful concurrence of fetal malformation and toxemia.

One baby had congenital syphilis. The diagnosis of retrolental fibroplasia was not made on any baby.

MISCELLANEOUS

Abruptio. There were 24 cases of abruptio, 3 per cent of the toxemia cases. They were distributed as follows: pre-eclampsia, 5; eclampsia, 0; chronic hypertensive disease, 12; chronic hypertensive disease with superimposed pre-eclampsia, 5; unclassified, 2. Six of the cases were terminated by cesarean section with 7 perinatal deaths (twins) and 18 ended in vaginal delivery with 10 perinatal deaths.

Bieber reported that in 1942 to 1952 the incidence of abruptio at the Charity Hospital was 0.44 per cent. On the Louisiana State University Services at the Charity Hospitals in New Orleans and Lafayette, Tatum found an abruptio occurrence of 0.5 per cent. It is important to realize that until 1951 the diagnosis of rupture of the marginal sinus was not recorded at the Charity Hospital; figures on abruptio under these conditions may be open to some adjustment (11).

Anemia. Practically every woman had a hemoglobin or hematocrit determination on admission. In this report hemoglobins of less than 10 grams per 100 milliliters or hematocrits of less than 30 per cent are considered evidence of anemia. When there was disagreement in the two tests a mean corpuscular hemoglobin concentration of less than 30 is used for the criterion of anemia. There were 43 women (6 per cent) with anemia. The distribution of anemia was pre-eclampsia, 20 cases; eclampsia, 2; chronic hypertensive disease, 8; chronic hypertensive disease with superimposed pre-eclampsia, 12; unclassified, 1.

Diabetes. Five mothers were diabetic. Each had a live baby that survived. One had a cesarean section because of the diabetes and the remainder had spontaneous labors and

deliveries. In 1950 early delivery of diabetics was not practiced as frequently as now.

Pyelonephritis. Twenty women (3 per cent) were treated in the hospital for pyelonephritis. Undoubtedly there were others treated on an outpatient basis.

Heart disease. Ten women were recognized as having heart disease that antedated the 1950 pregnancy. Five were clearly due to rheumatic fever. This group does not include women with long standing hypertensive cardiovascular disease and minor depletions of cardiac reserve.

Cesarean section. Forty-one patients (6 per cent) had cesarean sections. The primary indications were listed as: toxemia 12, disproportion 10, previous section 9, abruptio 5, faulty presentation 3, placenta previa 1, and diabetes 1.

Eye grounds. One hundred and thirty-five women had ophthalmoscopic examinations and 80 (59 per cent) were considered abnormal. The group with chronic hypertensive disease and superimposed pre-eclampsia had the greatest number examined and greatest percentage with abnormal fundi.

Electrocardiograms. Significant electrocardiographic changes were found in 36 (18 per cent) of the 205 women tested.

Chest roentgenograms. One hundred and forty-nine patients had x-ray films of the chest during hospitalization and 36 were abnormal. The most common abnormality was some degree of cardiac enlargement.

Other studies. Two hundred and fifteen patients had blood chemistry tests done at least once and 145 patients had at least 1 renal function test but the interpretation of these tests is beyond the scope of this paper.

Urinary suppression. No toxemic woman in 1950 had lower nephron nephrosis. One patient (with chronic hypertensive disease) is considered as having anuria, if we define anuria as no excretion of urine in a 12 hour period; this patient subsequently improved. Oliguria we define as the excretion of less than 600 milliliters of urine in any 24 hours. There were 12 patients with oliguria, 5 of whom had eclampsia.

Maternal death. There was 1 death among the toxemic women on the service in 1950. This patient had chronic hypertensive disease and died of pulmonary embolism after a cesarean hysterectomy.

The patient was a 38 year old colored para 9, gravida 11. She was known to have had hypertension for 17 years. Near term a cesarean section was performed because of 2 previous sections. The first section was done because of a large baby (15½ pounds). The operation was started under local anesthesia and finished under ethylene and ether. After delivery of twins a subtotal hysterectomy and bilateral salpingo-oophorectomy was done. One ovary contained a 7 centimeter dermoid cyst. The lower extremities were examined daily and there was no muscle tenderness or Homans' sign. The postoperative course was febrile due to pneumonitis but she was discharged well on the twelfth postoperative day. The day after discharge she collapsed at home and died suddenly. The coroner's diagnosis was pulmonary embolism.

Induction of labor. Labor was induced in 65 women. Pitocin infusion was the most popular form of induction and was used in 38 instances. We have no hesitancy in the employment of this method of induction in toxemia. Our use of pitocin infusion has increased since 1950. No considerable deleterious effect on toxemia has been observed (23).

SUMMARY

The problem of toxemia of pregnancy at the Charity Hospital in New Orleans was audited by means of a careful study of the hospital records of all of the patients delivered on the Tulane Service in 1950. The patients were from the low income group of the state and 82 per cent were Negroes. The patients with toxemia were designated by scrupulous adherence to definitions and were divided into groups with pre-eclampsia, eclampsia, chronic hypertensive disease without superimposed pre-eclampsia, and chronic hypertensive disease with superimposed pre-

eclampsia; there was a small unclassified group. Three thousand eight hundred and ninety-nine patients were delivered on the service in 1950 and 736, or 19 per cent, had toxemia. Forty-seven per cent of the patients had pre-eclampsia, and 47 per cent had chronic hypertensive disease. Forty-eight per cent of the patients with chronic hypertensive disease had pre-eclampsia superimposed on that illness. There were 10 eclamptics. The large Negro census did not seem to be the cause of the high rate of toxemia. There was 1 maternal death. The stillbirth rate of 6.5 per cent compared very favorably with the rates reported elsewhere. The cesarean section rate was 6 per cent and the primary indication for the operation in the majority of these women was not the toxemia.

REFERENCES

1. Agüero, O. El feto in las toxemias del embarazo (The fetus in the toxemias of pregnancy). Acta med., Venezolana, 1954, 2: 62.
2. Bieber, G. F. Review of 353 cases of premature separation of the placenta. Am. J. Obst. Gyn., 1953, 65: 257.
3. Burnett, L. F., and Hamel, J. I. Toxemia report for 1948. Bull. Margaret Hague Mat. Hosp., 1949, 2: 118.
4. Cosgrove, S. A., and Chesley, L. C. The clinical management of the late toxemias of pregnancy. Obst. Gyn. Survey, 1948, 3: 769.
5. de Watteville, H. Toxaemias of Pregnancy. Human and Veterinary. A Ciba Foundation Symposium. Pp. 202–203. Philadelphia: The Blakiston Co., 1950.
6. Dieckmann, W. J. The Toxemias of Pregnancy. 2nd ed. P. 46. St. Louis: C. V. Mosby Co., 1952.
7. Ibid., p. 623.
8. Douglas, R. G. 155th Annual Report of the Society of the Lying-in Hospital of the City of New York. P. 14. 1953.
9. Ferguson, J. H. Effect of stilbestrol on pregnancy compared to the effect of a placebo. Am. J. Obst. Gyn., 1953, 65: 592.
10. Idem. El funcionamiento de una clinica de toxemia para pacientes ambulatorios (The conduct of a toxemia clinic for ambulatory patients). Rev. obst. gin., Caracas, 1953, 13: 196.
11. Idem. Rupture of the marginal sinus of the placenta. Am. J. Obst. Gyn., in press.
12. Idem. The effect of a supplement of methionine and vitamin B on pregnancy and prematurity. Obst. Gyn., in press.
13. Ferguson, J. H., and Hinson, M. L. Importance of protein in maternal diets: and a Charity Hospital survey. J. Louisiana M. Soc., 1953, 105: 18.
14. Hamilton, J., Jeffcoate, T. N. A., and Lister, U. M. Foetal mortality in toxaemia of late pregnancy according to mode of delivery. J. Obst. Gyn. Brit. Empire, 1949, 56: 413.
15. Hendelman, M., and Philpott, N. W. A clinical report on the toxemias of pregnancy. Am. J. Obst. Gyn., 1952, 63: 72.
16. Hinson, M. L., and Ferguson, J. H. Food habits of pregnant women in Charity Hospital clinics. Bull. Tulane M. Fac., 1951, 10: 138.
17. Jones, W. S. Essential hypertension with superimposed pre-eclampsia. Am. J. Obst. Gyn., 1951, 62: 387.
18. Kaltreider, D. F., and Gilbert, C. R. Unexpected hypertension in the early and late puerperium. Am. J. Obst. Gyn., 1951, 61: 161.
19. Lundgren, L. E., and McDaniel, G. C. Toxemia report for 1950. Bull. Margaret Hague Mat. Hosp., 1952, 5: 16.
20. McCaw, W. H., and Parsons, R. M. Toxemia report for 1949. Bull. Margaret Hague Maternity Hosp., 1951, 4: 52.
21. Meyer, H. Hypertension following a normal pregnancy. Am. J. Obst. Gyn., 1938, 35: 150.
22. Meyer, H., and Nadler, S. B. Unexpected postpartum hypertension. Am. J. Obst. Gyn., 1941, 41: 231.
23. Schneider, G. T., Ferguson, J. H., and Miller, H. K. Intravenous administration of dilute pitocin in obstetrics. N. Orleans M. & S. J., 1951, 104: 139.
24. Seegars, W. Unpublished data.
25. Tatum, H. J. Placental abruption. Obst. Gyn., 1953, 2: 447.
26. Taylor, H. C., Jr., Tillman, A. J. B., and Blanchard, J. Fetal losses in hypertension and pre-eclampsia—I, an analysis of 4432 cases. Surg. Obst., 1954, 3: 225.
27. Wellen, I. Specific hypertensive disease of pregnancy; factors affecting infant mortality. Am. J. Obst. Gyn., 1952, 64: 271.
28. Idem. The infant mortality in specific hypertensive disease of pregnancy and in essential hypertension. Am. J. Obst. Gyn., 1953, 66: 36.

ADEQUATE GASTRIC RESECTION WITH GASTRODUODENOSTOMY

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GASTRIC RESECTIONS with gastroduodenostomy are descendents of the Billroth I operation. The popularity of these procedures has varied; at present they appear to be enjoying a resurgence of favor. Moore and Harkins, in their monograph on the Billroth I gastrectomy, and Wallenstein suggest that gastroduodenal anastomosis following gastrectomy is associated with fewer and less severe postgastrectomy symptoms than the conventional gastrojejunal anastomosis and, at the same time, affords at least equally good protection against anastomotic ulcer. If gastrectomy with gastroduodenostomy is to find itself a permanent niche in the surgeons armamentarium for the therapy of chronic peptic ulcer the operation should satisfy certain criteria: (1) The resection must technically fulfill the physiologic criteria of an adequate gastrectomy. (2) The mortality and morbidity must be no greater than presently utilized procedures. (3) The follow-up must indicate that the operation is associated with few postgastrectomy sequelae. (4) The incidence of anastomotic ulcer must be no greater than gastrectomy with gastrojejunostomy.

The third and fourth criteria will be answered by careful follow-up study, and by time; and, we shall not discuss them until a later communication. However, the short or long term follow-up, we believe, will be dependent on the performance and result of the first two criteria, and it is to these that this article shall be devoted.

Adequate gastrectomy connotes a different thing to different surgeons, and it is of some importance to define the term. This is particularly true if a gastroduodenostomy is contemplated. A surgeon planning to join a resected stomach to the duodenum may have a subconscious desire to leave behind a larger stomach pouch than is physiologically sound. The surgeon's therapeutic efforts on the stomach for the therapy of ulcer can be defined physiologically, as permanent interference with the stomach's ability to produce acid pepsin. We consider that this can best be done by resection of two-thirds to three-quarters of the stomach and, at the same time, removal of the entire antrum. The antrectomy, only if complete, abolishes the humoral or antral phase of gastric secretion. A two-thirds to three-quarters resection mechanically removes parietal cells leaving behind only a small percentage of cells to produce acid. Complete antrectomy in the patient with a chronic duodenal ulcer demands the removal of the ulcer, for the bulk of surgical duodenal ulcers occur in the first 2 or 3 centimeters of the duodenum. The ulcer that is so large and distorted as to tempt one to leave it behind is the very one that must be removed to insure total pylorectomy. We find it difficult in such ulcers to distinguish clearly between distal pylorus and proximal duodenum. In our experience, ulcer of the second portion of the duodenum is more common in surgical conversation than in actual practice.

The criticisms that gastroduodenostomy cannot be performed with adequate gastrectomy, that it is not applicable to the duodenal ulcer, and that it is associated with stomal obstruction and critical angle leakage have not materialized in our experience. Adequate gastrectomy and gastroduodenostomy, even in the patient with duodenal ulcer, can be accomplished with

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FIG. 1. Shows ligation of short gastric vessels and the left gastroepiploic artery. Note bare area of the stomach between these vessels. The point of transection of stomach at greater curvature (insert) is in the bare area just above the left gastroepiploic artery.

fulfillment of the second criterion of a low morbidity and mortality. We have had experience with this operation in 120 cases. There have been no deaths. We should like, therefore, to outline the technical steps of adequate subtotal gastrectomy with gastroduodenostomy with particular reference to the removal of the duodenal ulcer and mobilization of the duodenum.

The important features of adequate gastrectomy with gastroduodenostomy have to do, first, with sufficient mobilization of the stomach so that after resection of two-thirds to three-quarters the remaining stomach pouch can be swung from left to right to meet the duodenum without tension. Second, after resection of the duodenal ulcer, to mobilize the duodenum sufficiently to swing it from rignt to left to meet the resected portion of the stomach.

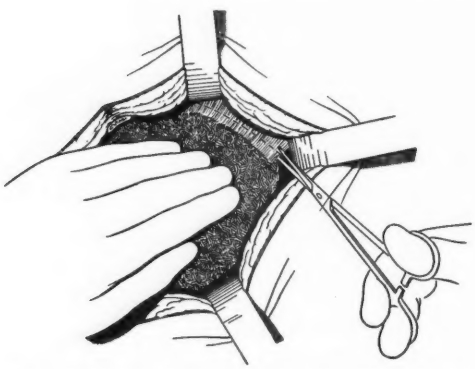

FIG. 2. Section of the triangular ligament of the left lobe of the liver.

Mobilization of the stomach is begun on the left side of the gastrocolic omentum. The left gastroepiploic artery is ligated, the bare area of the greater curvature is exposed, and the dissection is carried upward so that the lowermost two short gastric vessels are ligated (Fig. 1). This last maneuver releases the greater curvature from its position in the left upper quadrant and permits mobilization toward the duodenum. The left gastric artery is then ligated in the dome of the lesser sac and before it becomes opposed to the lesser curvature. At this point the surgeon can proceed to resect two-thirds to three-quarters of the stomach without guesswork by adhering to anatomic landmarks. Kocher clamps are applied to the greater curvature in the bare area above the entrance of the left gastroepiploic artery (Fig. 1, insert). The bite of the Kocher clamp should approximate the width of the duodenum so there will be a minimum of disparity in size between stomach and duodenum at the time of gastroduodenostomy. The stomach is now sectioned between the Kocher clamps and the incision is carried cephalad across the anterior and posterior walls of the stomach to a point on the lesser curvature about 1 to 2 centimeters below the esophagus. Latterly, we have accomplished this with greater ease by using the Von Petz clamp. These maneuvers have permitted the surgeon to accomplish an anatomic two-thirds to three-quarters resection leaving him with a gastric stump that has the approximate width of the duodenum and has such mobility that it can be swung to the right to meet the duodenum without tension. If further mobility of the pouch is necessary this can be accomplished by section of the left triangular ligament of the liver (Fig. 2). The anterior and

posterior walls of the stomach above the Kocher clamps can be approximated with a continuous row of locked sutures of No. 000 chromic catgut and a row of interrupted Lembert sutures of cotton (Fig. 3). If the Von Petz clamp is used only one row of interrupted Lembert sutures of cotton will suffice. It is important to end the mucosal suture line 5 to 10 millimeters from the Kocher clamp and to retain the suture long, as a marker for the duodenogastrostomy. With the Von Petz clamp a metal clip will be present at this point and a mucosal suture is not necessary. The serosal layer of sutures on the reconstructed lesser curvature is terminated 10 to 15 millimeters from the Kocher clamp and the cotton suture is left as a marker. These markers will afford accurate gastroduodenostomy and are important to prevent critical angle leakage.

Mobilization of the duodenum is the second important maneuver in this operation. In the presence of a chronic penetrating duodenal ulcer, resection of the ulcer and mobilization of the duodenum can be a technically difficult and tedious procedure. We abandoned duodenal gastric anastomosis in several early patients because of inadequate and traumatic mobilization of the duodenum. With experience we learned that duodenal ulcers with penetration into the head of the pancreas and associated with marked distortion and scarring could be, and were, treated successfully by the methods to be described.

The first step in duodenal mobilization regardless of the site of the ulcer is performed by the method of Kocher (Fig. 4). The peritoneum lateral to the duodenum from the foramen of Winslow well toward the superior mesenteric vessels is sectioned and the duodenum and head of the pancreas are elevated from the inferior vena cava. This maneuver brings the duodenum and common duct closer to the surgeon and makes subsequent dissection easier. A laparotomy pad is placed behind the duodenum and pancreatic head to keep these structures close to the anterior abdominal wall.

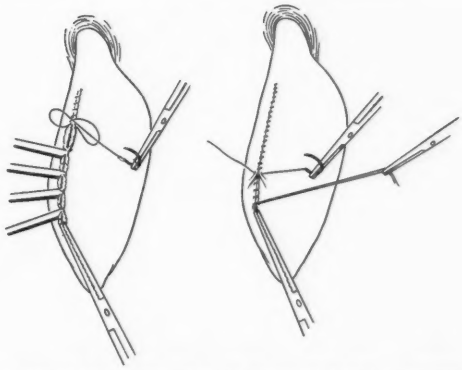

FIG. 3. Reconstruction of the new lesser curvature. Only one layer of interrupted sutures are necessary if the Von Petz clamp is used.

Prior to dissection of the normal duodenum or a duodenal ulcer from the pancreas the common duct must be exposed. This is done from the cystic duct down to the point at which the common duct passes behind the lateral sweep of the duodenum. Here one recalls the anatomic fact that if the duodenum is rolled medialward from its point of contact with the common duct the duct will be seen to enter the pancreatic head and will disappear from view well protected by the pancreas until it enters the

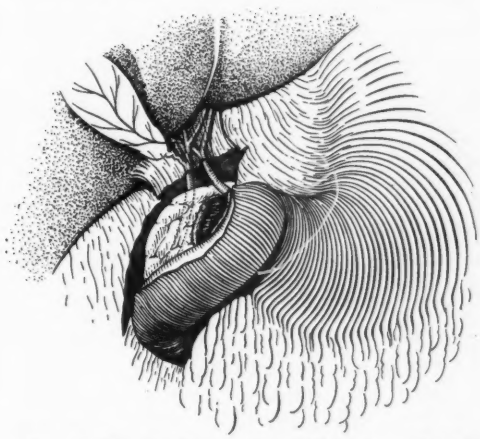

FIG. 4. The duodenum is mobilized by a Kocher maneuver. Note that as the duodenum is rolled medialward over the pancreas the common duct disappears from view and is well protected by the pancreas before it enters the duodenum several centimeters below the ulcer.

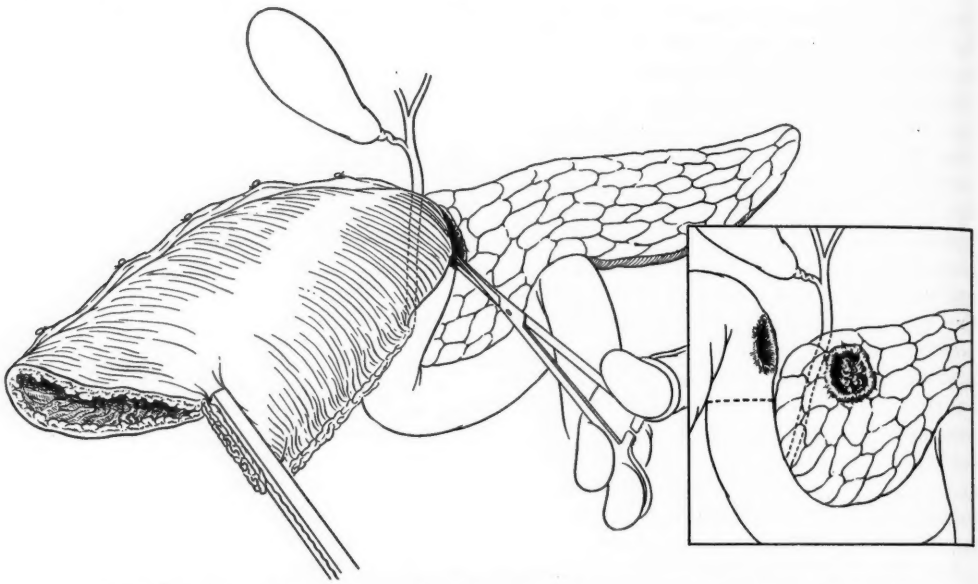

FIG. 5. Dissection of the duodenum from the head of the pancreas. Insert shows relation of dissected duodenum to the pancreas, ampulla, and ulcer crater. Note the common duct protected by the pancreas. Note the distance between ulcer and the entrance of the duct into the duodenum.

ampulla about 3 inches from the pylorus on the posterior medial wall of the duodenum (Fig. 4).

The distortion, edema, and scarring of the duodenum containing a chronic intractable ulcer give the impression that the ulcer is in juxtaposition to the common duct. If the duct is exposed to its point of disappearance into the pancreas, hazard of injury to the duct during the removal of a chronic ulcer or mobilization of the duodenum is remote. In addition, a segment of good duodenum can be developed from a point distal to the duodenal ulcer and proximal to the ampulla of Vater.

With the duodenum and head of the pancreas now mobilized and with the common duct exposed, the last step in the dissection remains, elevation and separation of the duodenum from the head of the pancreas. The gastric ulcer will present little difficulty. The right gastric and superior pancreaticoduodenal vessels are ligated, the small vessels entering the posterior wall of the duodenum from the pancreatic head are ligated, and the duodenum can be easily mobilized so that its normal course lateral to the pancreas can be changed to a course anterior to the pancreas. Thus the duodenum is swung from right to left and can be brought without tension to meet the previously prepared gastric pouch. Frequently the duodenum can be brought to the left of the vertebral column.

Dissection of a duodenal ulcer may in the presence of edema present no more problem than dissection of a normal duodenum. Dissection of a chronic penetrating ulcer is more tedious. However, if the surgeon uses the previously exposed common duct as a frequent reference point (Fig. 5) and if the dissection is carried from whatever direction it appears to proceed easily, the ulcer can be separated from the pancreatic head and sound duodenum distal to the ulcer can be mobilized (Fig. 5 insert). At times it is valuable to make an incision in the anterior duodenal wall close to the pylorus. The in-

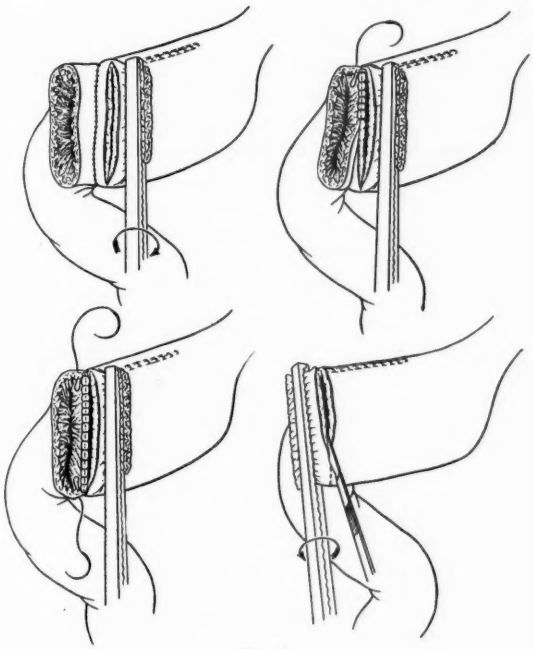

FIG. 6.

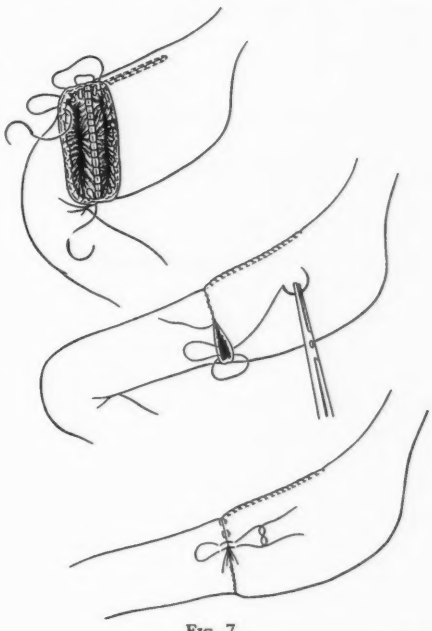

FIG. 7.

FIG. 6. Method of duodenogastric anastomosis. A layer of interrupted cotton is used as the first posterior layer. The posterior stomach wall is opened. A second posterior layer of No. 000 catgut is placed as a continuous lock suture. The anterior stomach wall is then sectioned and crushed tissue in the Kocher clamp is excised. Blood vessels in the stomach wall are ligated anteriorly.

FIG. 7. Mucosal continuous catgut which has been started in the middle of the second posterior row is brought around each corner as a Connell suture and completed in the middle of the first anterior row. The final anterior row is made up of interrupted Halsted mattress sutures of cotton.

FIG. 8. Method of placement of purse-string suture at the critical angle.

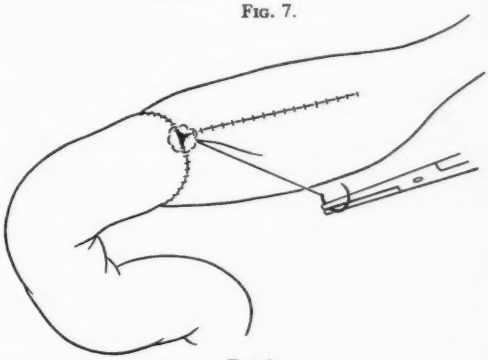

FIG. 8.

dex finger of the left hand inserted into the duodenum will aid in following the duodenal contortions made by a chronic ulcer. This dissection is at times associated with but little bleeding because of the paucity of blood vessels in the fibrous tissue. The bed of the ulcer in the head of the pancreas is not removed. The ulcer which has perforated into the pancreatic head has no posterior wall. The ulcer consists merely of a rim of duodenum. Resection of the floor of the ulcer in the pancreas will be associated with considerable bleeding and may injure pancreatic ducts and produce a pancreatic fistula. During dissection one must protect the integrity of the posterior wall serosa and muscularis of the duodenum which is to be used for anastomosis. If after mobilization of the duodenum the surgeon does not wish to do a gastroduodenostomy the mobilized duodenum can easily be closed, and the operation completed by gastrojejunostomy. Anastomosis is effected as illustrated in Figures 6 and 7. This is a

TABLE I

Diagnosis	*No. of cases*
Duodenal ulcer	76
Gastric ulcer	28
Jejunal ulcer	1
Pyloric stenosis due to mineral acid burn	1
Massive bleeders	
1 duodenal	
2 gastric (aged 75 and 78)	3
Total number of ulcers	109
Carcinoma of stomach	9
Lymphosarcoma of stomach	1
Leiomyoma of stomach	1
Total number of resections and gastroduodenostomy.	120

standard two layer anastomosis. The surgeon must use care to close the lesser curvature corner at the angle of three suture lines which is best done by a seromuscular purse-string suture that includes anterior duodenum, anterior stomach, posterior stomach, and posterior duodenum (Fig. 8). If the pancreatic head has been traumatized a drain is placed in this area and brought out of a stab wound lateral to the incision. Postoperatively a Levin tube is left in the stomach on constant suction for 48 hours. The usual gastrectomy feeding routine is then followed.

Our experience is summarized in Table I and covers 120 cases. These represent age groups from 25 to 79 years. These patients have not been selected and include 3 patients operated upon during the course of massive hemorrhage. Two of these patients were 75 and 78 years of age. Sixty-three of the patients were on the author's private service and operated upon by him. The remaining group were on the clinic service at the University Hospital and on the Fourth Surgical Division at Bellevue Hospital. These patients were all operated upon by the resident staff under supervision. A succession of senior residents, residents, and assistant residents are represented in this group of operators. A number of the operations were first gastrectomies. The operation was done for ulcer 109 times. In 11 patients resection and gastroduodenostomy were performed for tumor. The operation was designed to be curative in 1 instance each of leiomyoma and lymphosarcoma, and palliative for 9 carcinomas.

Our immediate postoperative results and abdominal complications are summarized as follows: One patient with a chronic duodenal ulcer developed a pancreatic fistula which drained through a stab wound and healed spontaneously. One patient developed postoperative vomiting that was thought to be due to a superior mesenteric artery obstruction of an extensively mobilized and rotated duodenum. This patient improved without surgery. There was 1 evisceration that was resutured. One patient developed fever on the sixth post-operative day which responded to antibiotics. The patient developed a stomal obstruction and was reoperated upon 3 months postoperatively. At reoperation it was believed that the cause of stomal obstruction was probably due to leakage of the anastomosis on the sixth postoperative day. One patient had an incision and drainage for subhepatic cellulitis. There have been no deaths.

SUMMARY AND CONCLUSIONS

The technical aspects of adequate gastrectomy with gastroduodenostomy have been presented in some detail. Our experience would indicate that this operation can be done with a low morbidity and mortality. The follow-up results of these operations will be analyzed in a subsequent study. We are continuing to perform this operation in accordance with the technical steps described. We hope thereby to have a technically homogeneous group of gastrectomies for long term study. We should like to emphasize our belief that this operation cannot succeed unless it fulfills the criteria of adequate gastrectomy.

REFERENCES

1. Moore, H. G., and Harkins, H. N. The Billroth I Gastric Resection. Boston: Little, Brown & Co., 1954.
2. Wallenstein, Sten, and Gothman, Lars. An evaluation of the Billroth I operation for peptic ulcer. Surgery, 1953, 33: 1–20.

AN EVALUATION OF THE PRACTICE OF ROUTINE POSTOPERATIVE NASOGASTRIC SUCTION

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THE PURPOSE of this presentation is to re-evaluate the routine use of nasogastric suction after elective major abdominal surgery. We believe this practice should be closely examined for the following reasons: (1) suction tubes can cause a wide variety of complications, some serious; (2) surgeons do not agree on the necessity nor duration of suction postoperatively; (3) intestinal distention appears to be minimal in the early postoperative period in the absence of complications; and (4) no suction at all was used on 130 out of 143 consecutive cases of major abdominal surgery. There was no mortality. No adverse effects were seen.

Probably every surgeon has seen complications associated with the use of suction tubes. While all are annoying, some are quite serious and a potential hazard is always present. We have encountered numerous instances of sore noses and sore throats, 1 case of massive distention from pressure being applied instead of suction, 2 instances of knotting of the tube making removal difficult, and 1 case of permanent partial vocal cord paralysis.

The literature contains many reports of injury following the use of tubes. A partial list of the more serious is presented in Table I. These complications required 49 immediate operations including 24 tracheotomies. In addition, the instances of laryngeal and esophageal injury almost always presented long term problems with multiple operations, dilatations, and permanent damage. Eight deaths were directly related to complications following the use of the tube.

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In addition, suction always removes valuable fluid and electrolytes. The proportions of this loss are often difficult to determine but the report of Taylor shows the magnitude that can be expected in the average hospital patient in whom suction is being maintained. In the sick or postoperative patient unnecessary and rapid depletion can add innumerable problems to management, even death.

This résumé of complications illustrates the ever present danger when a suction tube is in place.

There is no agreement among surgeons as to the necessity nor duration of suction postoperatively. A brief review of the literature shows wide differences of opinion and a survey of 45 practicing Seattle surgeons reveals a similar divergence of attitude concerning suction in the postoperative period, as shown in Table II. In both groups some did not use suction as a matter of routine while others thought it should be employed for a minimum of 3 to 4 days in every instance.

The reasons given by these local surgeons for maintaining suction in the postoperative period were: (1) to treat acute gastric dilatation or gastrointestinal distention and avoid tension on suture lines, (2) to treat prolonged nausea and vomiting, (3) to evaluate postoperative bleeding at an anastomosis, (4) to determine if it is safe to commence oral feedings by clamping off the tube, giving liquids by mouth and after an interval re-establishing suction and noting how well the stomach is emptying itself, and (5) for prophylaxis—to prevent gastrointestinal distention.

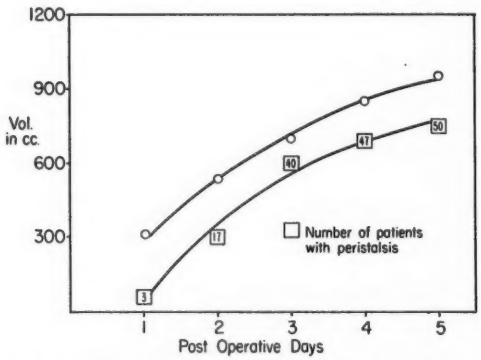

FIG. 1. Comparison of daily gastric secretion volumes with the return of peristalsis in 50 patients postoperatively. The numbers in the squares represent the total who had audible peristalsis on that day.

Without question suction should be instituted whenever distention is present preoperatively, during surgery, or postoperatively. Also, if the surgical lesion is an irritative one usually associated with prolonged ileus the use of the tube is logical. Intubation for diagnosis is justified. The pure prophylactic use of suction to prevent complications that are not likely to occur seems unwarranted, can be dangerous, and is always uncomfortable for the patient. In view of these circumstances, the disagreement among surgeons as to the necessity of postoperative suction is not surprising.

TABLE I. — COMPLICATIONS ASSOCIATED WITH INTESTINAL INTUBATION

Complication	*No. reported*
Severe injury to the nasal passages	5
Injury to the larynx leading to ulceration, cord paralysis, or stenosis	22
Injury to the esophagus with esophagitis, ulceration, perforation, stenosis, or rupture of varices	12
Perforation of the stomach or intestine	13
Obstruction from knotting, intussusception over the tube, or balloon distention*	39
Complications from spillage of mercury†	4
Severe disturbances in fluid balance	4

*Intestinal tube balloons causing obstruction have been distended with intestinal gas, milk shake, mercury, air, sulfa, and oral feedings.

†Mercury spillage is usually considered to be of little significance because of the innocuousness of the metal, yet 4 cases of unusual complications associated with mercury have been reported. These required 5 additional operations and led to 1 death.

The complications listed required 49 immediate operations, including 24 tracheotomies, and led to the death of 8 patients. In addition, the instances of laryngeal and esophageal injury almost always led to long term problems with multiple later dilatations and operations and usually were associated with permanent damage.

Intestinal distention appears to be minimal in the early postoperative period and does not represent a valid indication for suction in the usual case. Fifty consecutive patients on the surgical services of King County Hospital were followed after gastrointestinal surgery in whom continuous suction was maintained. Daily volumes were collected, the return of audible peristalsis was noted, and daily eosinophile counts were obtained in 8 cases. The results are shown in Figures 1 and 2. The volume of gastric secretion was low following surgery and did not return to normal amounts until the return of peristalsis was heard. Both motility and secretion followed the eosinophile count. Similar findings have been reported by Hardy on studies of intestinal secretion using Miller-Abbott tube suction volumes. Also, there is evidence that intestinal absorption is greatly diminished as well following injury or abdominal surgery. It appears that not only does peristalsis cease following trauma, as reported by Moore, but that secretion and absorption decrease as well. For this reason, in the usual case of elective surgery, fluid accumulation producing distention seems unlikely without a complication being present. When secretory activity does return peristalsis also returns to propel it along.

A more important factor in postoperative distention is air entering through the esophagus. This may be swallowed, but according to Maddock it usually enters during inspiration against a closed glottis in the presence of a relaxed pharyngoesophageal junction. This maneuver may be entirely unconscious and is often aggravated by pain or apprehension. In the absence of peristalsis the air remains in the upper intestine and stomach. In the erect position it is usually eructated. It cannot be removed by a Miller-Abbott tube unless the tube is resting high in the intestines. In fact, distention may actually be increased in the presence of such a tube holding open the pharyngoesophageal junction, necessitating the introduction of a second tube in order to decompress the stomach.

Significant distention postoperatively from fluid or gas in the absence of complications has been uncommon in our cases. When it has appeared a tube was put down at that time without jeopardizing the patient's course. The fact that distention might occur does not represent an indication for routine prophylactic suction.

No suction at all was used in 130 out of 143 consecutive cases of major abdominal surgery. These patients were instructed not to swallow anything and were given nothing by mouth until flatus was passed by rectum. There was no mortality. No adverse effects were seen. The clinical material is summarized in Table III. Suction was used in 13 instances in which specific indications were found at surgery. Of the 130 patients in whom no suction was instituted one will be mentioned. She was an elderly woman whose sigmoid colon, rectum, uterus, and over half of the vagina were removed for carcinoma. No peristalsis was heard for 7 days, and it was 9 days before her colostomy started to function. During that time she had no suction. Her abdomen was flat throughout the period. She had no cramps or unusual pain. Not only was she reasonably comfortable, but hydration and fluid balance were easy to maintain. Postoperative prophylactic suction could only have complicated recovery.

The cases in which suction was used will be briefly discussed.

Subtotal gastric resections—45 cases. Suction was instituted 7 times. In 1 case, postoperative suction was started because of a greatly dilated stomach. Pancreatitis developed and the nasogastric tube was maintained in place for 51 days before the process subsided. The tube did not prevent the complication, and the fluid removed before the pancreatitis developed added much uncertainty to the later fluid and electrolyte management.

In another patient no gastric suction was used after surgery. On the second postoperative day he was passing flatus per rectum and oral fluids were started. On the fourth day he began to have abdominal discomfort and the following day was regurgitating.

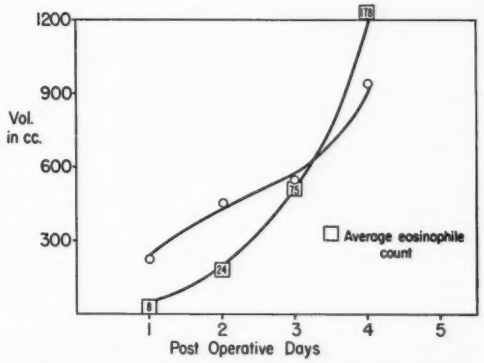

FIG. 2. Comparison of daily gastric suction volumes with daily eosinophile counts in 8 patients postoperatively. The numbers in the squares represent the average eosinophile count for that day.

Nasogastric suction was started for "stomal edema." In spite of continuous aspiration his condition worsened and a flat plate of the abdomen showed free barium in the peritoneal cavity. A barium enema several days before surgery had shown marked diverticulosis. One of these must have ruptured, presumably when the discomfort started. An ileostomy was done and the patient's recovery was complicated by hypernatremia and hypokalemia. Prophylactic suction from the time of surgery, with the attendant loss of fluids and electrolytes might have been sufficient to have led to the death of this 74 year old man.

Cholecystectomies including choledochostomy—57 cases. In 4 patients immediate postoperative suction was instituted for indications

TABLE II.—OPINION OF 45 PRACTICING SEATTLE SURGEONS CONCERNING THE NECESSITY OF ROUTINE POSTOPERATIVE SUCTION

Operation	*No. not using routine postoperative suction*	*No. using routine postoperative suction*	*Minimum duration of suction, days* 1	2	3	4
Cholecystectomy	20	23	9	8	3	
Perforated ulcer closure	7	34	6	7	9	1
Subtotal gastrectomy	4	36	5	8	9	5
Small bowel resection	10	30	5	6	7	4
Colectomy	12	28	5	5	6	3

TABLE III.—SUMMARY OF 143 CONSECTUTIVE CASES OF MAJOR ABDOMINAL SURGERY IN WHICH SUCTION AS A ROUTINE WAS NOT INSTITUTED

Operation	*Suction not used No. of cases*	*Suction used No. of cases*	*Total No. of cases*
Subtotal gastrectomy...	37	8	45
Cholecystectomy.....	53	4	57
Colectomy.....	19	0	19
Hysterectomy.....	22	1	23
Total.....	130	13	143

found at surgery. One patient developed pancreatitis and 1 developed bile peritonitis. Both did well.

Colectomy including abdominal perineal resections—19 cases. No patients had any form of postoperative suction whether a primary resection or a colostomy was done. None had trouble.

Total hysterectomies—23 cases. One patient developed cramps and distention postoperatively and required suction for 7 days. The cause of her difficulty was never determined.

Our personal experience has led us to discontinue the routine use of postoperative suction.

DISCUSSION

Ferguson, in an editorial in 1949, said, "The practice of preventing complications which never occur or never should occur is so widespread that the preoperative and postoperative care of patients has become a most complicated procedure for the doctor and a most troublesome time for the patient." He believed that one such practice was routine postoperative gastric suction. Eliminating suction in the cases presented made the nurses' work much easier, eliminated the uncertainty about the patency of the tube, made fluid and electrolyte balance easy to maintain, and removed one of the most uncomfortable features from the patient's standpoint. It has been our experience that complications are sometimes obscured by the presence of suction especially when an irritative or obstructive lesion develops. When such have appeared without suction the onset has been clear and instituting continuous aspiration at that time has not been harmful to the patient.

The patients presented were told before surgery that if they would not swallow anything until they passed flatus per rectum it would not be necessary to use postoperative suction. Most were very co-operative. The tube was put down without any hesitation if indications appeared. This happened in 2 of the 143 cases discussed in the foregoing.

From a different perspective there are other justifications for re-evaluating the routine use of nasogastric suction following abdominal surgery. Advancement in the control of infections, the increased understanding of the importance of nutrition and blood volume, fluid and electrolytes, and an appreciation of homeostasis and some of the factors in wound healing have all significantly reduced the incidence of postoperative complications. This alone should be an adequate reason to question a procedure introduced to anticipate these complications and their sequellae.

SUMMARY

Some of the more serious complications associated with gastrointestinal intubation are presented.

The disagreement among surgeons as to the necessity of routine postoperative suction is pointed out and a survey of practicing Seattle surgeons regarding this question is presented.

Data are given on 50 consecutive abdominal surgical cases in which continuous suction was maintained, showing that both motility and secretion in the stomach cease following surgery and that secretion does not return until motility returns to propel it along. In 8 patients these factors were correlated with the eosinophile count.

Clinical material is presented in which no suction at all was used in 130 out of 143 consecutive cases of major abdominal surgery. The cases in which it was necessary to put down a tube are briefly discussed and evaluated.

Other reasons for re-evaluating routine suction are given in the discussion on the subject.

CONCLUSIONS

1. Suction tubes can cause a wide variety of complications, some quite serious.

2. Surgeons do not agree on the necessity of routine suction after gastrointestinal surgery.

3. Motility, secretion, and absorption all decrease in the stomach and intestine following surgical trauma, and secretion does not normally return until peristalsis returns to move it along.

4. No suction at all was used on 130 out of 143 consecutive cases of major abdominal surgery. These patients were instructed not to swallow anything and were given nothing by mouth until flatus was passed by rectum. There was no mortality. No adverse effects were seen.

5. Medical advances have greatly reduced the incidence of certain postoperative complications.

6. For the reasons given we believe that the practice of routine postoperative nasogastric suction after gastrointestinal surgery should be re-evaluated, and intubation should be used only when specific indications exist.

REFERENCES

1. Ferguson, L. K. Simplicity in surgery. Surg. Gyn. Obst., 1949, 88: 539.
2. Hardy, J. D. The adrenal cortex and postoperative gastrointestinal secretions. Surgery, 1951, 29: 517.
3. Maddock, W. G. Gastrointestinal gas. Ann. Surg., 1949, 130: 512.
4. Moore, F. D. Bodily changes in surgical convalescence. Ann. Surg., 1953, 137: 289.
5. Taylor, F. W. Electrolyte loss by postoperative nasal gastric suction. Arch. Surg., 1953, 66: 538.

JUXTA-ESOPHAGEAL GASTRIC ULCER

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IT IS FORTUNATE that gastric ulcers are situated most frequently along the lesser curvature of the stomach at or near the "angle." This location permits the surgeon to inspect, palpate, and resect the ulcer in the majority of patients with little difficulty. The duodenum is usually normal and mobile, and the operation commonly can be completed with a Billroth I type of anastomosis. The first problem that confronts the surgeon in such a case is to determine whether the lesion is benign or malignant. The help of a competent pathologist who is familiar with microscopic examination of fresh frozen tissue is most important in this regard. The pathologist usually studies multiple sections of tissue taken from selected regions in and around the ulcer before he is willing to state that the lesion is definitely benign. Obviously, it is important for the surgeon to know whether the lesion is benign or malignant while the operation is still in progress, as the scope of the surgical procedure is different for a malignant lesion than it is for a benign ulcer.

In a relatively small number of patients who have gastric ulcer, the lesion is situated in close proximity to the esophagogastric junction or perhaps this region actually is involved in the induration and inflammatory reaction that surround such an ulcer. Under these circumstances, the difficulties of diagnosis as to the benign or malignant nature of the lesion, as well as of surgical treatment, are all greater than they are when one is dealing with the usual gastric ulcer. Therefore, it was thought that it might be of interest to review a group of patients in whom the diagnosis was made of gastric ulcer situated in juxtaposition to the esophagus and in whom surgical treatment was instituted.

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PRESENT STUDY

In the present study, a review was made of the records of all patients who were operated upon at the Mayo Clinic with the preoperative or postoperative diagnosis of "ulcerating lesion of the stomach" or benign gastric ulcer between the years 1940 and 1946, inclusive (969 patients). Fifty patients, approximately 5 per cent, had lesions situated within 2 inches of the esophagogastric junction; these patients form the basis of this report. With these criteria for selection, we have information on the frequency of malignancy in indeterminate ulcerating lesions in this region. However, we have no information on the frequency with which lesions called malignant by the roentgenologist were actually benign or malignant. Follow-up data were available on 44 of these patients 5 years or more after operation; in 30 patients these data were gained by letters and in 14 by re-examination.

DIAGNOSIS

Only 9 of the 50 patients were female (average age 65 years). The 41 male patients averaged 51 years of age. The symptoms produced by a gastric ulcer situated near or adjacent to the esophagus are comparable to those caused by a similar ulcer situated in another part of the stomach. Forty-two of the 50 patients complained of intermittent epigastric pain that occurred at varying intervals after meals, often at night and usually with periodic exacerbations. Four patients had abdominal pain atypically localized. Of the remaining 4 pa-

tients, 1 complained of a constant "lump on his stomach," 1 had indigestion after eating fried or fatty foods, and 2 complained of nausea and vomiting immediately after eating. Thirteen of the 50 patients complained of epigastric pain located in the midline under the xiphoid or high in the left portion of the epigastrium.

General examination usually revealed no findings characteristic of a high-lying gastric ulcer, although tenderness was noted occasionally high in the epigastrium or slightly to the left of the midline. The diagnostic procedures employed most often were roentgenologic and gastroscopic examination, especially the former.

Roentgenologic studies. Roentgenologic examination was the most accurate diagnostic procedure, although this was not infallible. The original roentgenologic examination in 41 patients revealed a high gastric ulcer and localized it correctly. One or more roentgenologic examinations in 9 patients showed no abnormalities, although these patients were experiencing symptoms of ulcer. The ulcers in 4 of these 9 patients were missed on repeated examination, whereas the ulcer in 1 patient was seen and correctly located on a second examination. The ulcers in the other 4 patients were seen on repeated examination but were inaccurately localized in the stomach by the roentgenologist. The ulcers in 7 of the 46 patients in whom a lesion was visualized were called "probably malignant" by the roentgenologist but only 2 of these ulcers proved subsequently to be carcinoma. Of 6 ulcers in which "malignancy could not be excluded" by the roentgenologist, all were benign on pathologic examination. In the remaining 33 of the entire group of 46 patients in whom the ulcer was seen roentgenologically, no suggestion of a malignant lesion was reported by the roentgenologist. One ulcer in this group of 33 patients proved on microscopic examination to be surrounded by adenocarcinoma.

Gastroscopic studies. Gastroscopy was performed on 16 of the 50 patients. This examination did not prove to be of great value, which is easy to understand because of the location of the lesion in a region that is most difficult for the gastroscopist to view accurately and completely. The ulcers in 7 of these 16 patients were not seen or were incorrectly localized. In 1 instance the examination was unsatisfactory. In only 8 patients (50 per cent) were the ulcers seen and correctly localized. Of the 16 patients in whom gastroscopy was performed, 7 were diagnosed as having malignant lesions that actually proved to be benign. In only 1 patient was a malignant lesion correctly diagnosed. It is apparent, therefore, that the roentgenologic examination is more accurate in the diagnosis of a high-lying gastric ulcer than is gastroscopy.

PATHOLOGIC CHARACTERISTICS

A malignant lesion was found in 3 (6 per cent) of the present series of 50 patients in whom the diagnosis of gastric ulceration was made preoperatively. In 2 of these patients the diagnosis of neoplasm was made by biopsy without histologic study of the lesion itself; the neoplasm in 1 of these 2 patients was found by microscopic examination of an adjacent lymph node, whereas study of an excised serosal implant on the gastric wall revealed similar findings in the other. Examination of the resected lesions revealed neoplasm in only 1 of the remaining 48 patients.

This experience is not unlike that reported in the literature. Rieder, in 1939, reviewed the records in 120 cases of ulcer of the gastric cardia collected from the literature; 4 (3.3 per cent) of the lesions proved to be malignant. Of 55 similar patients reported upon by Köle, in 1950, 1 (1.8 per cent) died of gastric carcinoma after a Kelling-Madlener procedure. Finsterer reported that 2 patients from a group of 79 upon whom he had performed operations of this type died of gastric carcinoma 2½ and 4 years postoperatively. It is not known whether or not these malignant lesions were present at the time of the original operation

and, if so, whether or not biopsy would have revealed the true nature of the lesion.

The location of a juxta-esophageal ulcer is of interest to the surgeon in determining the most desirable type of operation. In the present series of patients, 26 had ulcers situated high on the lesser curvature, 12 had ulcers on the lesser curvature and posterior wall, and 10 had ulcers entirely on the posterior wall; the ulcers in 2 patients were located on the lesser curvature and anterior wall. In 7 of the 10 patients who had ulcers on the posterior wall, the lesions were near the lesser curvature. Therefore, it is apparent that the lesion is situated on or near the lesser curvature in the large majority of patients who have a high-lying gastric ulcer; therefore, if it does not actually involve the esophagogastric junction, the ulcer might be eradicated by some type of partial gastrectomy that removes all or nearly all of the lesser curvature. Unfortunately, some of these ulcers may be located so close to the esophagogastric junction that ordinary operations of this type are not applicable.

TREATMENT

Certainly one of the most important things to be decided by the surgeon is whether he is dealing with a benign or a malignant lesion; this decision should be made as soon as possible after the abdomen is opened. The presence of an obviously malignant lesion can be determined with little difficulty. On the other hand, if a benign ulcer actually is present, it may be difficult or impossible to exclude malignancy with certainty until after the lesion is resected and in the hands of the pathologist. The gross appearance and "feel" of the tissues may give valuable and usually correct information to the experienced surgeon. In actual practice, this frequently may constitute the essential evidence on which the working diagnosis is based. If an operation has been performed for a benign lesion that on immediate examination by the pathologist after its removal proves to be malignant, then additional structures must be removed as indicated in the individual case. Biopsy, while it may not always afford conclusive evidence of the true nature of the ulcer, should be performed on equivocal lesions before resection is undertaken.

If the ulcer proves to be malignant, the surgeon will, of course, have different criteria relative to the extent of resection and removal of adjacent tissues and structures than if he were dealing with a benign lesion. If the ulcer is benign, one wishes to eradicate the disease and prevent recurrence of ulceration. This latter objective is currently accomplished in almost all cases by resection of the lesion and a generous amount of the stomach, although actually it appears likely that gastric resection of the same magnitude as is commonly advocated for duodenal ulcer is really not necessary to prevent recurrence in a high percentage of patients who have gastric ulcer. It would appear well to keep in mind the many fine results obtained in past years with local excision and gastroenterostomy in the treatment of gastric ulcer; this is especially important for the surgeon who performs gastric surgery only occasionally or when an unusually difficult situation is encountered. It is true that treatment of this type will not be employed often but it may be used to advantage in a limited group of circumstances.

Although partial gastrectomy with removal of the ulcer is currently employed in the majority of patients who have a high-lying gastric ulcer, other procedures, such as sleeve resection, resection of the esophagus and cardia, vagotomy and gastroenterostomy with or without local excision, and total gastrectomy, have been suggested. In addition, the aforementioned Kelling-Madlener operation, in which the ulcer is permitted to remain in place and distal gastric resection is performed, has been utilized by some surgeons. Vagotomy appears to have little, if any, place in the treatment of gastric ulcer. Sleeve resection of the upper portion of the stomach with removal of the ulcer has had only limited usage and, therefore, it is difficult to assess its results accurately;

TABLE I.—RESULTS 5 YEARS* AFTER VARIOUS SURGICAL PROCEDURES FOR JUXTA-ESOPHAGEAL GASTRIC ULCER

Surgical procedure	*Cases*	*Results*					
		Excellent	*Good*	*Fair*	*Poor*	*Postoperative death*	*No follow-up*
Subtotal gastric resection, including ulcer	29	17	6	1	1	1	3
Total gastric resection	6	0	2†	1†	0	3	0
Transthoracic resection of cardia	2	0	0	2	0	0	0
Excision of ulcer and distal gastric resection	2	2	0	0	0	0	0
Vagotomy	3	1	0	0	2	0	0
Excision or cautery and gastroenterostomy	4	2	0	0	2	0	0
Suture of edges of ulcer together	1	0	0	0	1	0	0
Total	47	22	8	4	6	4	3

*One patient died of coronary occlusion and another of a cerebrovascular accident within the 5 year period; both had experienced excellent results before death.
†Two patients had pernicious anemia and 1 patient had an indeterminate anemia.

however, it appears desirable to remove the antrum of the stomach. The incidence of esophagitis and the high morbidity and mortality rates, as well as the high percentage of unfavorable postoperative functional results, after resection of the cardia and total gastrectomy make these operations undesirable.

As already indicated, 3 of the 50 patients in the present series were found to have gastric carcinoma. Twenty-nine of the remaining 47 patients were treated by subtotal gastric resection with removal of the ulcer. The remaining 18 patients were subjected to a variety of surgical procedures, including: total gastrectomy (6 patients), local excision and gastroenterostomy (4), vagotomy (3), transthoracic resection of the cardia (2), excision of the ulcer associated with distal resection of the stomach (2), and suture of the edges of the ulcer (1). A Hofmeister-Polya type of partial gastrectomy was used most often. A Shoemaker-Billroth I type of gastroduodenostomy was done in some patients.

The ulcers situated closest to the esophagus usually present the most difficult problems from a technical viewpoint. In 21 of these patients, the ulcer was located "just below," "almost at," or within 1 centimeter of the esophagogastric junction; partial gastric resection including the ulcer was technically feasible in 18 of these patients. Of the 6 patients in whom the ulcer was thought to lie immediately adjacent to the esophagus, 4 underwent total gastrectomy and 2 had transthoracic resection of the cardia. Total gastrectomy is obviously not the treatment of choice for benign gastric ulcer. However, in some instances it may appear to be the only solution to a difficult surgical problem. Local excision in other cases may establish the benign nature of the lesion. Biopsy of an apparently benign gastric ulcer, the tissue being taken from within the stomach, may give reliable information as to its true nature. According to Dockerty, however, more than 1 specimen is necessary in approximately 25 per cent of cases to establish the diagnosis of neoplasm when this actually is present.

Although it may be difficult or impossible to establish definite rules to guide the surgeon in dealing with a region of chronic ulceration situated in the stomach near the esophagus, certain general principles appear to be fairly clear. Total gastrectomy or esophagogastrectomy is not a desirable procedure for a benign lesion; however, it may be indicated for a malignant one. The risk to the patient of total gastrectomy is such that it is well to take several specimens for biopsy from within and without the stomach if one is confronted with an ulcer situated so close to the esophagus that it can only be removed by total gastrectomy; if immediate study reveals no neoplasm, then it is probably better to perform distal resection of the stomach rather than total gastrectomy. Partial gastrectomy with removal of the ulcer is the operation of choice in the treatment of most gastric ulcers. In certain cases in which

this cannot be satisfactorily performed, local excision and gastroenterostomy may be done, as already mentioned. The Kelling-Madlener operation would not appear to be the procedure of choice when the ulcer can be removed without performing total gastrectomy.

SURGICAL RESULTS

The surgical results obtained at least 5 years after operation were determined in 44 of the 50 patients (Table I). The 6 patients whose results are not mentioned in the follow-up study include 3 who had carcinoma and 3 on whom follow-up information was inadequate. Thirty of the group of 44 patients obtained excellent or good results, 10 had only fair or poor results, and 4 died during the postoperative period. Patients who had excellent results experienced complete relief of all symptoms. Those who had good results were satisfied with the operation but occasionally had some digestive symptoms. Those who had only fair results had dumping symptoms, some other type of distress after meals, or a nutritional problem. It should be emphasized again that a number of surgical procedures were employed. The best results were obtained after removal of the ulcer by partial gastrectomy. Thus, of the 25 patients who had this operation and who were eligible for 5 year studies, 17 had excellent results and only 1 had a poor result; of the remaining 7 patients in this group, only 1 had symptoms that were really troublesome. There was no instance of proved recurrent ulcer.

Other surgical procedures were followed by less favorable results. Thus, of the 6 patients in whom total gastrectomy was performed, 3 died during the postoperative period and the remaining 3 experienced incomplete relief in that they were required to take medication for anemia, experienced some type of digestive disturbance, or had difficulty in maintaining weight and strength. The 2 patients in whom local excision and distal gastric resection were performed both enjoyed excellent results. Only 2 of the 4 patients in whom local excision and gastroenterostomy were performed experienced excellent results. Transthoracic resection of the cardia was followed by incomplete relief in the 2 patients in whom it was done and vagotomy alone, which was performed in 3 patients, was followed by excellent results in 1 and poor results in 2 patients.

SUMMARY

A review has been made of the records of 50 patients who had surgical treatment for gastric ulcers located within 2 inches of the esophagogastric junction. Such ulcers comprised 5 per cent of all gastric ulcers for which operation was done at the Mayo Clinic between 1940 and 1946, inclusive. They do not differ appreciably from other gastric ulcers with regard to age or sex incidence or with respect to symptoms. Roentgenologic examination is the best method of localization and diagnosis and is far superior to gastroscopy, which has little to offer in such lesions.

These ulcers are located on or near the lesser curvature in the great majority of cases. Therefore, they lend themselves to the Hofmeister modification of the Polya partial gastrectomy. When the ulcers are extremely close to the esophagus, biopsy and distal partial gastrectomy or perhaps gastroenterostomy appear preferable to total gastrectomy or esophagogastrectomy as a means of treatment. Use of these procedures should produce a 90 per cent incidence of excellent or good results, and rarely should a carcinoma be missed.

REFERENCES

1. Dockerty, M. B. Personal communication.
2. Finsterer, H. Zur chirurgischen Behandlung des cardianahen Ulcus ventriculi. J. internat. chir., Brux., 1949, 9: 1–26.
3. Kelling, G. Zur Pylorusresektion bei pylorusfernem Magengeschwuer. Zbl. Chir., 1924, 51: 172–174.
4. Köle, W. Zur Frage der Resektion des kardianahen Magengeschwueres. Zbl. Chir., 1950, 75: 611–624.
5. Madlener, M. Erfahrungen mit der "palliativen" Resektion beim cardianahen Magengeschwuer. Zbl. Chir., 1939, 66: 360–362.
6. Rieder, W. Chirurgische Behandlung des kardianahen Ulcus ventriculi. Arch. klin. Chir. (Lagenbeck), 1939, 196: 640–655.

THE DIFFERENTIAL ABSORPTION OF RADIOACTIVE ISOTOPES IN ARTIFICIALLY CONSTRUCTED AND NORMAL BLADDERS IN DOGS

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THE PRESENT STUDY undertakes to investigate the absorption of radioactive isotopes[1] from canine urinary bladders which were reconstructed by means of inverted seromuscular grafts from the ileum. The technique for reconstruction of the bladder with seromuscular grafts from the intestinal tract has been previously described by Shoemaker and Gratzinger and their associates (5, 10), and their studies have demonstrated that the reconstructed organ becomes lined with a transitional cell epithelium which is morphologically indistinguishable from the normal bladder epithelium (11). The object of the present study is to compare the physiologic behavior of the lining of this reconstructed bladder with reconstructed bladders lined with intestinal mucous membrane and with normal canine bladders by using radioactive iodine, sodium, and phosphorus.

HISTORY

In an extensive review of the early literature on absorption from the urinary bladder, Mann and Magoun found that numerous investigators using a wide variety of substances were able to obtain more or less definite evidence of absorption through the mucosa of the bladder. Usually, only tiny amounts or traces were found to be absorbed. A few of the early investigators, as Gerota, failed to obtain evidence of absorption. These authors found absorption of phenolsulfonphthalein and indigocarmine which had been instilled in the bladder after both ureters had been ligated and severed. Relatively small amounts of dye were found to be excreted from the kidney. After injecting cocaine into the urethra, Rupel and Harger in 1937 recovered significant amounts of this substance in the urine. Conradt in 1938 found that the isolated living vesical did not absorb pure water, nor sodium chloride from a physiologic solution. Slight amounts of urea were absorbed apparently because of its ease of diffusibility, and solutions containing both urea and sodium chloride were found by Conradt to absorb only urea.

These and other test substances were analyzed by rather gross techniques. Recently, Maluf, using an ingenious method of bladder pressure equilibration and flame photometric determinations, found no appreciable net diffusion of Na^+, Cl^-, K^+, water, and glucose through the bladder from isotonic or slightly hypertonic solutions. He did find appreciable diffusion of urea from isotonic and hypertonic solutions as well as diffusion of distilled water. Absorption of unaltered protein through the bladder mucosa escaped detection until an indirect method of detection was devised by Waltzer. He used an immunologic response in previously sensitized rhesus monkeys and human beings to detect the entrance of the protein into the circulation. The use of radioactive tracers as a method to test absorption of various substances through the bladder mucosa was attempted by Marucci and associates. They used

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This thesis has been accepted by the Faculty of the Graduate School of Medicine of the University of Pennsylvania, toward the requirements for the degree of Master of Medical Science (M. Sc. (Med.)) for graduate work in Urology.

[1] Obtained from Oak Ridge National Laboratory, Oak Ridge, Tennessee. A.E.C. Authorization Numbers 23885, 25058, and 23886.

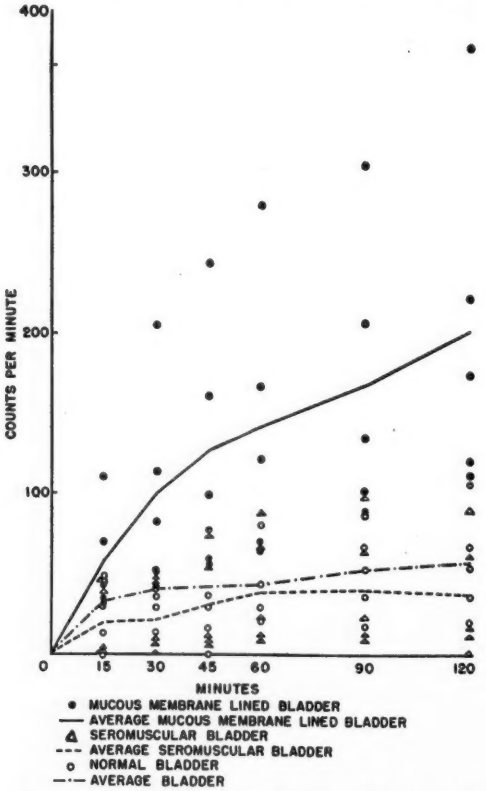

FIG. 1. Peripheral blood levels following installations of radioactive iodine in bladder. Complete data and average values for each type of bladder are shown.

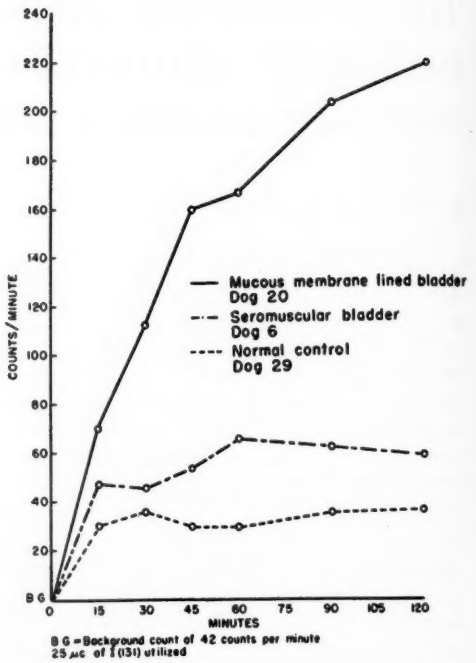

FIG. 2. Differential absorption of radioactive iodine in individual representative bladders.

radioactive iodine, sodium, and phosphorus as test substances and found traces of these in the peripheral blood. Previously and unknown to them, Burgess and associates (1, 2) used radioactive phosphorus, mercury, copper, sulfur, and gold instilled in the bladder of animals whose ureters were severed and cannulated. These investigators found traces of the test materials in the excreted urine, proportional to the concentration instilled.

MATERIALS AND METHODS

Fifteen mongrel male and female dogs weighing 12 to 15 kilograms form the basis of this report. Five dogs were used in the preparation of bladders reconstructed from seromuscular grafts of the ileum. Under intravenous sodium pentobarbital and pentothal anesthesia the abdomen was opened and a loop of terminal ileum approximately 20 centimeters in length was severed from the gastrointestinal tract. The isolated loop was opened longitudinally close to the mesenteric border, and the mucous membrane was elevated and removed, thus creating a viable seromuscular graft with an intact mesenteric blood supply. Subtotal excision of the bladder was carried out leaving only the trigone and a narrow margin around the urethra and ureteral orifices. The graft was anastomosed to the trigonal remnant with the serosal layer facing inward. A dePezzer catheter was placed in the reconstructed bladder lumen, brought through a separate stab wound in the abdominal wall, and the wound closed in layers.

Five dogs were prepared in the identical manner except that the mucous membrane

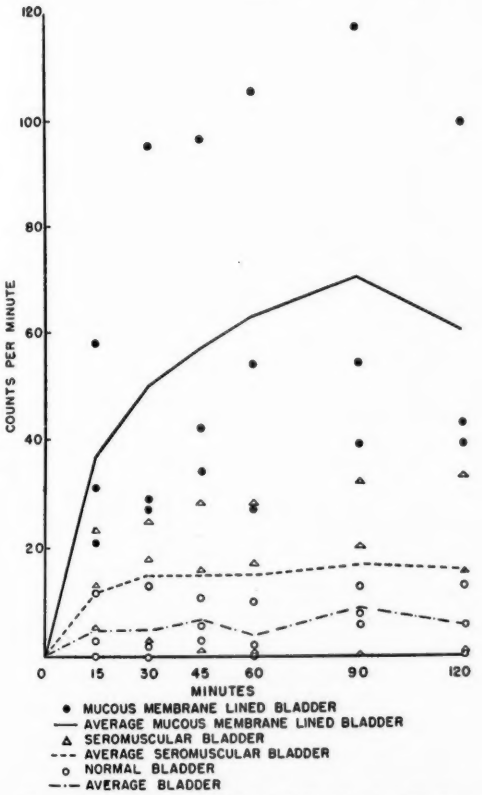

FIG. 3. Peripheral blood levels following installations of radioactive phosphorus in bladder. Complete data and average values for each type of bladder are shown.

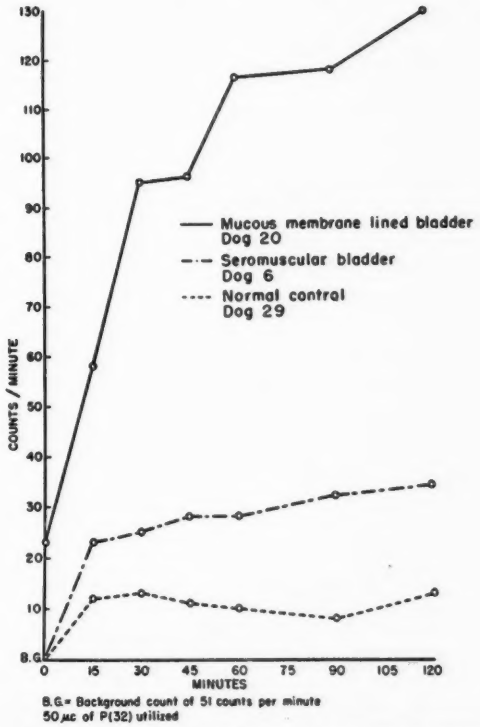
COUNTS / MINUTE
MINUTES
Mucous membrane lined bladder Dog 20
Seromuscular bladder Dog 6
Normal control Dog 29
B.G.
B.G.= Background count of 51 counts per minute
50 μc of P(32) utilized

FIG. 4. Differential absorption of radioactive phosphorus in individual representative bladders

of the ileum was preserved and placed on the luminal aspect of the reconstructed organ, so that the artificial bladders constructed were lined with intestinal mucous membrane.

Five dogs with normal bladders were used as controls.

All animals were prepared in an identical fashion. Food was withheld for 12 to 24 hours and the dogs were then anesthetized with intravenous sodium pentobarbital. The male animals were catheterized with No. 7 ureteral catheters, and the females with No. 14 Foley catheters. The bladders were then washed with sterile water and evacuated. Control blood and urine samples were taken at the beginning of the study.

Twenty-five microcuries of radioactive iodine were used on each of 15 dogs, 5 microcuries of radioactive sodium were used on each of 13 dogs, and 50 microcuries of radioactive phosphorus were used on each of 9 dogs making a total of 37 studies. In each instance the test dose was diluted in 20 milliliters of isotonic saline solution and instilled into the bladder. Following this, 10 milliliters of sterile water were introduced into the catheter to clear it of radioactive material. All isotopes were carrier free. Blood samples of 5 to 8 milliliters were taken at 15, 30, and 45, 60, 90, and 120 minutes.

All radioactive assays were performed on 1 milliliter aliquots of plasma evaporated to dryness on iron planchettes of 2 centimeter diameter. A thin window (2.1 mgm./cm.^{2}) Geiger-Mueller counter was employed with

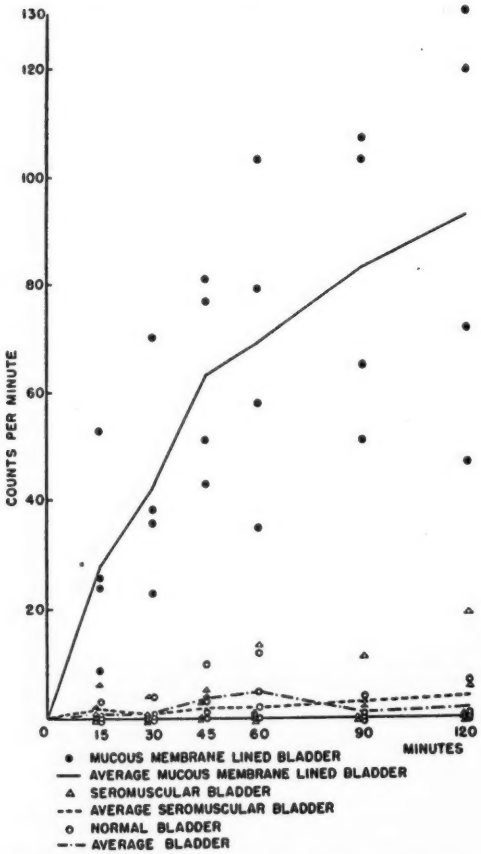

FIG. 5. Peripheral blood levels following installations of radioactive sodium in bladder. Complete data and average values for each type of bladder are shown.

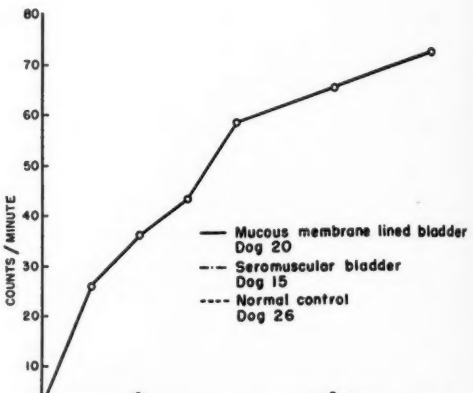

FIG. 6. Differential absorption of radioactive sodium in individual representative bladders.

a conventional scaler. Since all of the isotopes were hard emitters, corrections for self-absorption were unnecessary. All counting was performed on the same day of the experiment and under the same conditions. Counting was continued to give a maximum statistical error of 5 per cent.

RESULTS

The experimental results in 5 normal dogs subjected to the previously described I^{131} method revealed that only minimal quantities of radioiodide ion were transported across the mucosa. Each of the 5 animals whose bladders were reconstructed with seromuscular grafts gave comparable findings. However, all of the 5 animals whose bladders were replaced with ileal segments with intact mucous membrane showed rapid absorption of the I^{131} ion with continually increasing peripheral blood levels over the 2 hour period of observation. Figure 1 graphically represents the data and average values from the 3 types of bladder studies, while Figure 2 shows values from individual representative bladders using radioactive iodine.

Ion transportation patterns similar to those obtained with the use of radioactive iodine resulted when radioactive sodium was used in each of 4 ileal mucous membrane-lined bladders and when radioactive phosphorus was used in each of 3 ileal mucous membrane-lined bladders. Four normal animals and 5 animals with seromuscular bladders showed no statistically significant radioactive sodium ion absorption over the test period while 3 normal and 3 seromuscular bladders consistently showed minimal radioactive phosphorus ion transportation. Figures 3 and 4 represent radioactive phosphorus ion transporta-

tion patterns while Figures 5 and 6 represent radioactive sodium ion transportation patterns from each of the 3 types of bladders.

The circulating plasma volume of representative animals was determined by means of the albumen bound I^{131} technique and a rough quantitation of the amount of the tracer substances absorbed was attempted. Calculations revealed approximately 4 per cent of the 5 microcurie dose of radioactive sodium was transported into the circulation in the first hour in the mucous membrane-lined bladders. After 2 hours approximately 6 per cent of the test dose was found in the circulating plasma. About $1/16$ to $1/20$ of the amount was found in the peripheral blood of animals with normal and seromuscular reconstructed bladders.

It should be noted that the curves did not continue upward in a linear fashion, but began to level off noticeably at approximately 45 minutes after the beginning of the experiment. It is believed that this leveling off represents further dissipation of the ions into the other extracellular spaces.

DISCUSSION

The use of radioactive tracer substances has greatly simplified the problem of ion transportation as well as increased the accuracy of the determinations since physiologic levels are essentially unaltered by the test doses utilized.

Results obtained from each of the 3 groups of animals using each of 3 test materials are remarkably consistent when compared with their respective average values. Intestinal mucous membrane-lined bladders show rapid and continued radioactive iodine, sodium, and phosphorus ion transportation into the circulation, in contrast to the markedly limited absorption of these ions by the normal bladder. Values obtained with bladders reconstructed from seromuscular grafts of the ileum are entirely comparable with the normal, suggesting that the transitional cell lining which forms on the seromuscular bladder grafts from the ileum is not only morphologically indistinguishable from the normal but is physiologically indistinguishable from the normal according to the techniques mentioned.

SUMMARY

Absorption of radioactive iodine, sodium, and phosphorus is rapid and continuous in intestinal mucous membrane-lined constructed bladders but only minimal in normal bladders and those reconstructed from seromuscular grafts of the ileum.

The morphologically identical transitional cell lining of normal bladders and bladders constructed from seromuscular grafts of the ileum absorb radioactive iodine, sodium, and phosphorus in a physiologically identical manner.

REFERENCES

1. BURGESS, L. E., ROLFE, D. T., HAHN, P. F., and CAROTHERS, E. L. Permeability of the urinary bladder to radioactive phosphorus, mercury and gold. Fed. Proc., Balt., 1950, 9: 21.
2. BURGESS, L. E., ROLFE, D. T., HAHN, P. F., HOLMES, E. E., and CAROTHERS, E. L. Permeability of the urinary bladder to radioactive mercury, calcium and sulphur. Fed. Proc., Balt., 1951, 10: 21.
3. CONRADT, J. La resorption vesicale existe-t-elle? Arch. internat. physiol., Liege, 1937, 45: 325–331.
4. GEROTA, D. Ueber die Anatomie und Physiologie der Harnblase. Arch. Physiol., Leipzig, 1897, 428–472.
5. GRATZINGER, P., SHOEMAKER, W. C., MARUCCI, H. D., ULIN, A., and MARTIN, W. L. The use of inverted seromuscular grafts in bladder repair. Ann. Surg., 1954, 140: 832–838.
6. MALUF, N. S. R. Absorption of water, urea, glucose and electrolytes through the human bladder. J. Urol., Balt., 1953, 69: 396–404.
7. MANN, F. E., and MAGOUN, J. A. H. Absorption from the urinary bladder. Am. J. M. Sc., 1923, 160: 96–106.
8. MARUCCI, H. D., SHOEMAKER, W. C., WASE, A. W., STRAUSS, H. D., and GEYER, S. V. Permeability of the normal and artificially constructed canine bladder to I^{131}, Na^{22}, and P^{32}. Proc. Soc. Exp. Biol., N.Y., 1954, 87: 569–571.
9. RUPEL, E., and HARGER, R. M. Cocaine absorption in urethra and bladder. J. Urol., Balt., 1937, 37: 300–307.
10. SHOEMAKER, W. C., and MARUCCI, H. D. The experimental use of seromuscular grafts in bladder reconstruction. J. Urol., Balt., 1955, 73: 314–321.
11. SHOEMAKER, W. C., TEDESCHI, C., and GRATZINGER, P. Morphologic changes in intestinal grafts used in bladder reconstruction. To be published.
12. WALTZER, M. Absorption of allergen. J. Allergy, 1942, 13: 554–562.

THE CASE AGAINST SEGMENTAL RESECTION FOR ESOPHAGEAL CARCINOMA

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THE DEFINITION of an adequate surgical procedure for the cure of cancer implies a wide local resection of the tumor-bearing area in continuity with the regional lymphatic vessels and lymph nodes. The ability to accomplish this goal in patients with carcinoma of the esophagus is directly proportional to the absence of transverse spread to adjacent vital structures and the ability to encompass the longitudinal extent of disease. The limitations enforced by the degree of transverse spread are primarily dependent upon the segment of esophagus involved and are reflected in the 5 year survival rates following resection, in which an improving prognosis from above downward is generally recognized. An adequate explanation for this occurrence is afforded by the anatomic topography of the various esophageal segments. However, little emphasis has been focused on the longitudinal extent of disease, and, as a result, this factor has been relegated to a position of secondary importance. There are several reasons which probably account for this circumstance. The initial successful extirpation of an esophageal carcinoma was accomplished by Torek with his now abandoned procedure. The performance of this method of surgical resection was in large part necessitated by the lack of what we consider adequate facilities to permit reconstruction of the gastrointestinal tract in one stage. During the past decade the improvements in anesthesia, antibiotics, and blood replacement and an increased knowledge of electrolyte balance have permitted the much more impressive operative procedure of partial esophagectomy with re-establishment of continuity in one stage. In addition, many surgeons consider resection of upper and middle third lesions with their attendant poor prognosis as primarily a palliative procedure, and that such palliation is best achieved with a one stage operation. Finally, the economic loss of prolonged hospitalization has discouraged multistage operations. So impressive are these factors that the surgeon in recent years has been preoccupied largely with the problem of reconstruction rather than extirpation of the disease. A review of the numerous reports stressing the value of stomach, bowel, skin, fascia, wire mesh, and plastic prosthesis as replacements for defects of the esophagus following segmental resection provides ample evidence of this misguided emphasis.

A superficial review of our series of cases of esophageal resection had indicated a higher incidence of an inadequate longitudinal resection than is generally recognized. Recently Sweet justified the performance of a palliative resection with its resultant correction of the associated dysphagia by stating that: "recurrence of tumor at the site of anastomosis is a rarity even in those who succumb eventually to the disease." Because of this discrepancy, an intensive investigation of our cases was made. Results of this study follow.

STUDY

In order to increase the number of cases analyzed to a significant level, we requested

From the Department of Surgery, Memorial Center for Cancer and Allied Diseases, New York.

permission to include cases from the New York Hospital—Cornell Medical Center. From this series of cases of carcinoma of the esophagus, only those patients subjected to resection were considered for analysis. The investigation includes patients with epidermoid carcinoma arising from any one of the three thoracic esophageal segments as well as the cervical esophagus. Eight patients who had undergone the Torek procedure were excluded from study because it was believed that this procedure represented a subtotal esophagectomy rather than segmental resection. One Torek was included because of the fact that only a small portion of the esophagus was excised and this operation represented to us a limited segmental resection rather than a wide subtotal resection. After meeting these criteria, there were 79 cases available for review; 62 of these patients were from Memorial Center from the years 1940 through 1951, and 17 were from New York Hospital from the years 1942 through 1951. As implied in the introductory statement, we purposely have avoided any consideration of the factor of transverse spread of carcinoma beyond the confines of the esophagus as we believe this point has received sufficient emphasis.

For the purpose of statistical analysis the cases were placed into one of three classifications: (1) determinate positive group, (2) determinate negative group, or (3) indeterminate group.

The determinate positive group consists of those patients who represent examples of an inadequate longitudinal resection. One or more of the three following criteria had to be satisfied before a patient was placed in this category: (1) microscopic demonstration of carcinoma at the margin of resection of the surgical specimen; (2) microscopic demonstration of recurrent tumor at the line of anastomosis by examination of biopsy specimen; or (3) microscopic demonstration of tumor at the line of anastomosis on autopsy specimen.

We are aware that tumor may occur at the line of anastomosis as a result of invasion of residual tumor from the periesophageal tissues. In some cases the exact source of recurrent carcinoma cannot be determined. Nonetheless, we believe that the majority of cases placed in the determinate positive group represent examples of inadequate longitudinal resection.

TABLE I.—DISTRIBUTION OF CASES

	Determinate positive	*Determinate negative*	*Indeterminate*	*Total*
Cervical	7	0	2	9
Upper	3	0	3	6
Middle	16	5	16	37
Lower	10	4	13	27
Total: No.	36	9	34	79
Per cent	45.6	11	43.4	100

The determinate negative group is composed of those patients who unequivocally did not have recurrence at the line of anastomosis and whose surgical margins were clear. Obviously, only those patients subjected to a postmortem examination and found free of carcinoma on microscopic examination of the anastomotic site can be included in this category. In certain instances residual tumor was found in lymph nodes, in the posterior wall of the tracheobronchial tree, and in other periesophageal tissues; however, unless tumor was found within the line of anastomosis, the case was considered to be determinate negative.

The indeterminate group is large because a postmortem examination must be performed in order to state definitely that there is no recurrence. The latter group includes the following cases:

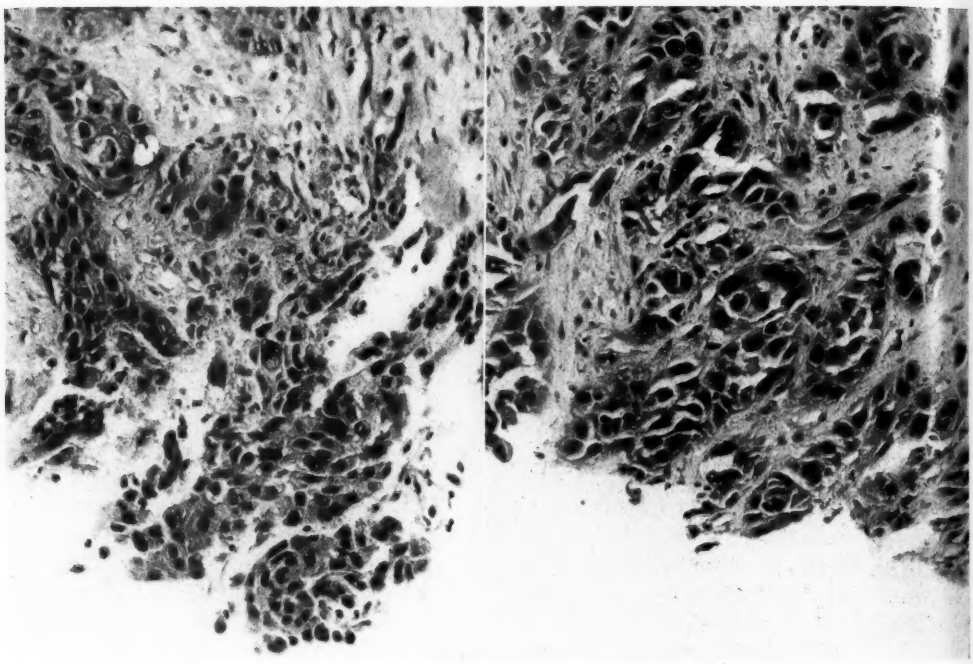
1. Those patients who are alive and well with no evidence of disease (2 after more than 5 years).

2. The margins of resection were not examined microscopically.

3. Microscopic examination was negative and the follow-up incomplete.

4. A frozen section was taken at the margin of resection and reported as positive. The surgeon then removed an additional cuff of the esophagus but the latter specimen was not examined by the pathologist.

5. The patient developed symptoms suggestive of local recurrence, but a positive biopsy was not obtained.



a b

FIG. 1. Case 1. a, Carcinoma at the superior margin of resection. ×345. b, Carcinoma at the inferior margin of resection. ×345.

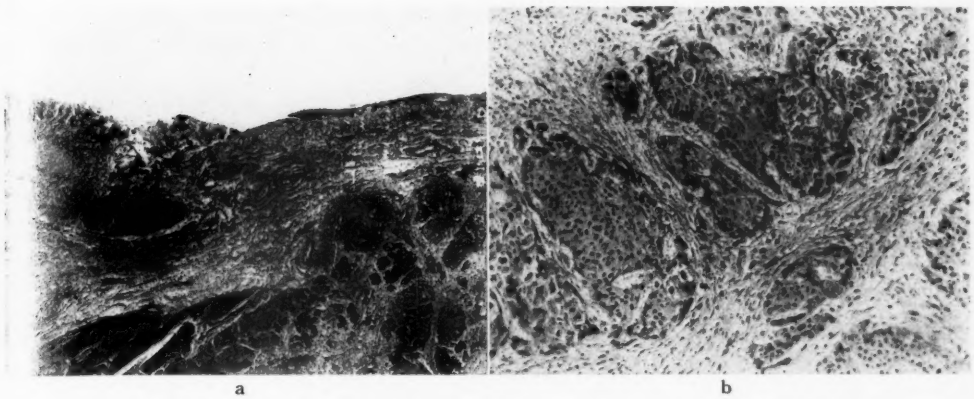
A summary of our findings on the basis of this classification is shown in Table I. Reference to this table reveals the relative incidence of the segmental origin of esophageal carcinoma in our series. The predominant site of origin is the middle third of the thoracic esophagus, whereas the distal third is second in frequency.

Of the 79 patients analyzed, 36 were placed in the determinate positive group. This means that at least 45.6 per cent of the patients with esophageal carcinoma who were subjected to segmental resection had an inadequate longitudinal excision. Furthermore, if the series were limited only to those cases about which a definite statement can be made, namely the determinate positive plus the determinate negative group (a total of 45 cases), 80 per cent had an inadequate longitudinal resection. The true figure probably lies somewhere between these two, inasmuch as a study of the indeterminate group would have undoubtedly yielded some individuals with positive microscopic evidence of local recurrence had such examination been available.

As examples of the determinate positive group the following protocols are presented.

CASE 1. C. P. This patient underwent a total laryngectomy, cervical esophagectomy, and bilateral radical neck dissection with preservation of the left internal jugular vein on December 4, 1951 for carcinoma of the cervical esophagus. Reconstruction was to be performed at a later date. Pathologic examination of the surgical specimen revealed carcinoma at both the superior and inferior margins of resection of the esophagus (Fig. 1). Her condition gradually deteriorated, and she expired on April 19, 1952.

CASE 2. F. G. was found to have carcinoma of the middle third of the esophagus. On February 24, 1950 a right thoracoabdominal esophagectomy with esophagogastrostomy was performed. Pathologic examination of the specimen failed to include microscopic examination of the margins of resection. He enjoyed a



a b

FIG. 2. Case 2. a, Shows line of anastomosis from postmortem examination. ×2. b, Demonstrates carcinoma in the submucosal lymphatics. ×260.

s[illegible]factory convalescence until March 1951 at which t[illegible]e he noted increasing dysphagia. A barium swallow r[illegible]aled stenosis at the line of anastomosis. In spite of i[illegible]nsive symptomatic therapy he expired 2 months l[illegible]r on May 6, 1951. Postmortem examination re-v[illegible]led carcinoma at the line of anastomosis (Fig. 2).

CASE 3. E. C. was diagnosed as having carcinoma [illegible] the middle third of the esophagus and was sub-j[illegible]ted to a right thoracolaparotomy on February 25, 1[illegible]49. Partial esophagectomy with esophagogastros-t[illegible]my was performed. On the first postoperative day he suddenly expired from a pulmonary embolus. Post-mortem examination revealed a residual focus of epi-dermoid carcinoma in the esophagus just above the line of anastomosis (Fig. 3).

CASE 4. P. B. underwent a left thoracolaparotomy for a carcinoma of the distal third of the esophagus on December 8, 1949. He expired on the first postopera-tive day, and no autopsy was permitted. However, pathologic examination of the specimen revealed car-cinoma in situ just at the upper margin of resection of the esophagus (Fig. 4).

CASE 5. E. B. An Ivor Lewis procedure (left para-median and right thoracotomy incision) was per-formed on this patient for a carcinoma of the middle third of the esophagus on April 10, 1951. Pathologic examination of the specimen revealed the margins to be clear. Grossly the tumor extended to within 1 cen-timeter of the proximal line of resection (Fig. 5a). Convalescence was satisfactory until June 1952 at which time he complained of increasing dysphagia. Esophagoscopy and biopsy of the line of anastomosis was reported as carcinoma in August 1952 (Fig. 5b). His subsequent course was palliated to some extent by the use of supervoltage irradiation.

These cases illustrate the point that the surgeon cannot accurately judge the longitudinal extent of the tumor. In the majority of them the surgeon thought that he had removed an adequate margin of normal tissue. The microscopic extent of the tumor may be considerably greater than is suspected from palpation and gross inspection. Even a pathology report of normal margins is incomplete assurance against local recurrence, for the embolic spread of tumor in the submucosal lymphatics will permit an area of normal esophagus to intervene between the primary tumor and a residual metastatic focus in the esophageal wall. One of us (WLW) demonstrated this point in 1933 (4), and it probably accounts for the course in Case 5. Extension of tumor through the submucosal

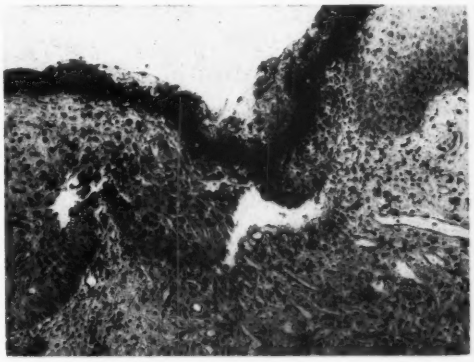


FIG. 3. Case 3. Shows a small focus of carcinoma in situ just above the line of anastomosis. ×125.

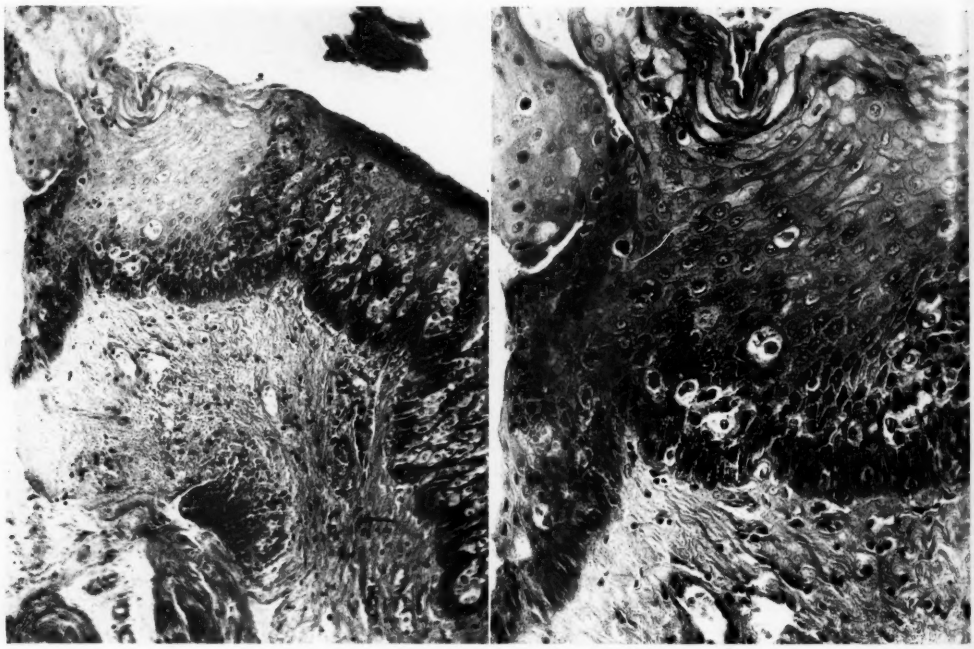


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FIG. 4. Case 4. a, Shows carcinoma in situ at the margin of resection. ×170. b, High power view of the area of the carcinoma in situ. ×340.

and periesophageal lymphatics is depicted in Figure 6.

The following case is presented at length because of its unusual aspects. We were uncertain about its classification and for that reason it is not included in this series. The details of management have been presented elsewhere (5, 6).

S. I., a 47 year old white female, developed dysphagia in 1933. In 1938 she noted pain on swallowing and particles of food lodged in the pharynx. In March 1940, an ulcer of the cervical esophagus was biopsied and reported as epidermoid carcinoma. A gastrostomy was performed and the patient was referred to one of us (WLW). The biopsy slide was reviewed and the diagnosis confirmed. Esophagoscopy revealed a granular lesion on the posterior wall at the entrance of the esophagus. On April 30, 1940 the upper cervical esophagus was exteriorized. On May 9, 1940 a right hemithyroidectomy and excision of the exteriorized esophagus was performed. The surgical specimen revealed some changes due to exteriorization, but no tumor could be identified. Multiple reconstruction procedures utilizing skin were completed in 1943. The patient was well until 1947, when evidence of recurrence appeared. The area of recurrence was excised, and this was followed by x-ray therapy. Grossly, the recurrence had the appearance of a new primary carcinoma of the skin graft. The pathologist was uncertain whether it originated in the skin or the esophagus. Plastic revisions were completed in November 1948. When last seen in early 1955, the patient was well and free of any evidence of tumor.

The basis for classification within the determinate positive group (36 cases) is summarized as follows: positive margins, 17 cases; positive biopsy, 12 cases; positive autopsy, 7 cases.

It is to be noted that 17 patients out of a total of 36 were considered to have had an inadequate longitudinal resection of the esophagus based solely on the finding of carcinoma at the margin of resection on microscopic examination. The validity of such an assumption is substantiated by the subsequent clinical course in the majority of patients. In only 1 instance was it otherwise.

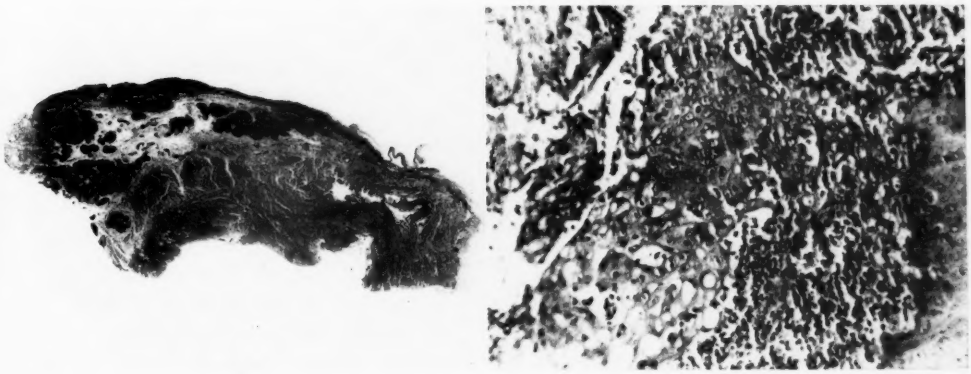

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FIG. 5.

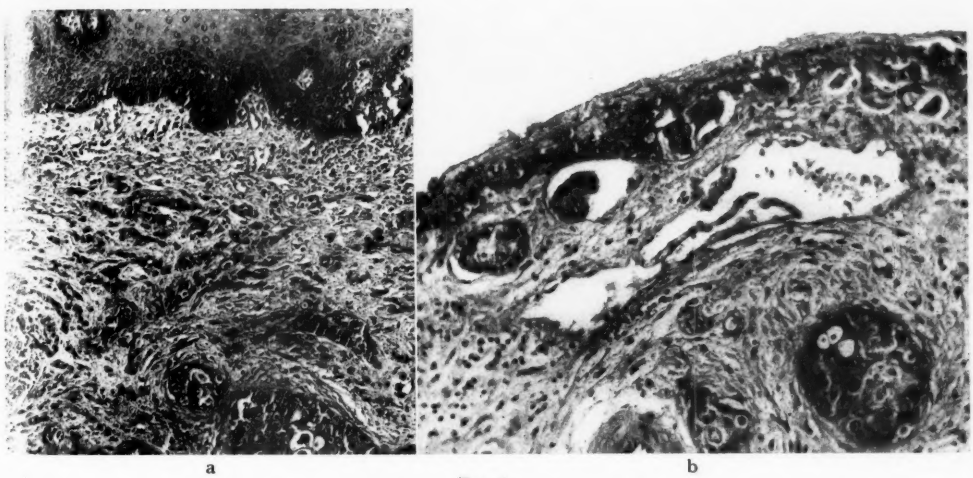

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FIG. 6.

FIG. 5. Case 5. a, Shows a 1 centimeter margin of normal tissue beyond the carcinoma in the submucosal lymphatics. ×2. b, Shows biopsy of recurrent carcinoma at the line of anastomosis 16 months after operation. ×260.

FIG. 6. a, Demonstrates tumor plugs in the submucosal lymphatics underlying normal squamous epithelium. ×145. b, Demonstrates tumor plugs in the periesophageal lymphatics. The upper margin is pleura. ×290.

This patient was treated with x-ray therapy for carcinoma of the left tonsil in 1941. On November 3, 1949, a partial esophagectomy was done for carcinoma of the distal one-third. Pathologic examination of the specimen was reported as: "Epidermoid carcinoma, grade 3, with submucosal extension to cardia. In situ carcinoma at proximal line of resection. Except for the latter finding this suggests a curable situation and would even suggest the desirability of reoperating to get additional proximal esophagus if possible." The patient was observed carefully during the follow-up period. Multiple esophageal biopsies obtained by endoscopy were reported as negative for carcinoma. Papanicolaou smears of esophageal washings were class 3. He developed a third primary carcinoma in the base of the tongue on the right side. On September 22, 1953, a combined operation of radical neck dissection in continuity with resection of the mandible and base of tongue was performed. His course was progressively downhill and he died on December 14, 1953, slightly more than 5 years after esophagectomy. An autopsy was not done.

DISCUSSION

The statistical analysis given discloses a surprisingly high incidence of carcinoma at the margin of esophageal resection or local recurrence of tumor at the site of anastomosis; 45.6 per cent of a series of 79 patients with epidermoid carcinoma were found to fall in this category. It is probable that even a higher percentage would have been obtained if transverse rather than longitudinal sections of the margins of resection had been studied.

On the basis of these figures it is apparent that segmental resection for esophageal carcinoma is often an inadequate surgical procedure. A greater portion of the esophagus should usually be removed. One of the more important aspects of the Torek procedure which has not received sufficient emphasis is the removal of a considerable length of esophagus, allowing ample margins of normal tissue beyond both the proximal and distal margins of the cancer. Resection of an adequate margin of normal tissue on the proximal side with immediate reconstruction can often be done on lesions in the lower one-third. To provide ample margins for lesions in the proximal and middle one-third, however, a subtotal esophagectomy is usually necessary; the anastomosis should be done above the clavicle. We are fully aware of the fact that even though complete extirpation of the longitudinal extent of tumor is accomplished, the presence of residual disease infiltrating adjacent vital structures will often nullify the chance of cure.

In order to improve the survival rate, we propose that an extensive resection be done as the first part of a two stage procedure. As a result of deferral of reconstruction, there should be a reduction in operative time, blood loss, and manipulation of other organs with a parallel reduction in operative morbidity and mortality. These benefits could be utilized to permit a more vigorous attack on the transverse as well as the longitudinal spread of the tumor. This effort could be directed at the en bloc removal of the regional lymphatics and to the utilization of new techniques in the resection and repair of the tracheobronchial tree and large vessels. A course of radiation therapy could be given in the interval between the two stages. If reestablishment of continuity at the time of resection is considered to be of major importance, the surgeon must realize that the chances of cure are jeopardized unless he removes ample normal tissue beyond the cancer.

SUMMARY

1. A series of 79 patients who had segmental resection of the esophagus for epidermoid carcinoma was analyzed to determine the incidence of inadequate resection as based on microscopic evidence of carcinoma at the margin of resection or the development of recurrence of tumor in the line of anastomosis.

2. Of this entire series 45.6 per cent of the patients were considered to have had an inadequate resection of the esophagus on the basis of these criteria.

3. Of the determinate group of this series 80 per cent of the patients were considered to have had an inadequate resection.

4. Transverse rather than longitudinal sections of the margins of esophageal resection should be subjected to microscopic examination routinely.

5. In order to improve the cure rate of carcinoma of the esophagus by surgical methods, it is necessary to excise a greater portion of the esophagus than is now done with segmental resection.

REFERENCES

1. Lewis, I. The surgical treatment of carcinoma of the esophagus. Brit. J. Surg., 1946, 34: 18.
2. Sweet, R. H. The results of radical surgical extirpation in the treatment of carcinoma of the esophagus and cardia; with 5 year survival statistics. Surg. Gyn. Obst., 1952, 92: 46.
3. Torek, F. The first successful case of resection of the thoracic portion of the esophagus for carcinoma. Surg. Gyn. Obst., 1913, 16: 614.
4. Watson, W. L. Cancer of the esophagus. Surg. Gyn. Obst., 1933, 56: 884–897.
5. Idem. Cancer of the cervical esophagus. Ann. Surg., 1942, 116: 86–96.
6. Watson, W. L., and Converse, J. M. Reconstruction of the cervical esophagus. Plastic & Reconstr. Surg., 1953, 11: 183–196.

NEW FASCIA PLASTIC REPAIR OF ENTEROCELE

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ENTEROCELE is not nearly so rare as the rather sparse literature indicates, although it is not a common complaint. Even so, the discomfort and disability it causes justify more care in diagnosis and a better method of repair than the classic operations usually recommended. We present, therefore, a promising new technique especially adapted to repair of postoperative enteroceles through the pelvic floor and large primary enteroceles through the upper posterior vaginal wall.

INCIDENCE OF ENTEROCELE

Phaneuf (9, 10) has reported 91 enterocele cases and Reed 167 cases. Weed and Tyrone collected 52 cases from the Ochsner Clinic and the Charity Hospital in New Orleans—an incidence respectively of 1 in 986 and 1 in 1,168 admissions. Folger, in discussing their paper, reported that 95 enteroceles (61 repaired) had been recorded in 52,996 admissions to the University Hospitals of Cleveland. The incidence was 1 operation in 869 admissions and 1 enterocele in 558 admissions.

We have not found in the literature any statistics showing the incidence in gynecologic cases, and the following figures, therefore, may be of interest. Recently, we surveyed 2,319 of our own gynecologic cases treated during the 13 years from 1942 to 1954 inclusive. Operations included 1,696 hysterectomies (1,260 abdominal, 163 vaginal, and 273 composite), 719 cystourethrocele repairs, 886 perineorrhaphies, and 73 enteroceles (6 not yet repaired)—a total of 3,374 major surgical procedures. The incidence of 73 enteroceles in 2,319 cases is 3.15 per cent, or 1 in 31.8 cases. In the 3,374 surgical procedures, the incidence is 2.16 per cent, or 1 in 46.2 cases.

DEFINITION OF ENTEROCELE

In this article, enterocele is defined as any herniation of small intestine into the vagina. Primary enterocele is a herniation through the posterior wall of the vagina behind the cervix, often referred to as posterior vaginal hernia. Secondary enterocele is a herniation through the floor of the pelvis. Primary enterocele is found in patients with an intact uterus or following supracervical hysterectomy, as the intact ligaments prevent herniation through the pelvic floor. Secondary enteroceles are found only after complete hysterectomy, although a postoperative enterocele is not necessarily of secondary type. In this study, 16 primary type enteroceles were found after panhysterectomy, compared to 13 secondary type enteroceles.

ETIOLOGY OF ENTEROCELE

Primary enterocele usually is erroneously described in the literature as appearing in the cul-de-sac of Douglas, dissecting its way down between the posterior wall of the vagina and the anterior wall of the rectum. It is agreed that probably there is a congenital basis, since it has been reported in nulliparous women (our series includes 1 such case). Most often the congenital defect has been described as an abnormally deep cul-de-sac. Reed, for example, emphasizes the importance of this condition, and cites an anatomic study by Uhlfelder which showed that the cul-de-sac varies in depth as a result of developmental anomalies. We fail, however, to see how descent of small intestine in a cul-de-sac, shallow or deep, can be classed as a hernia unless there is a defect in the peritoneum which permits outpouching of small intestine into the vagina, rectum, or perineal body. As a matter of practical ob-

TABLE I.—PREVIOUS SURGERY AND ENTEROCELE REPAIRS

Previous surgery	*Sac closed*	*Perineorrhaphy*	*Colpocleisis*	*Moschcowitz*	*Colles' fascia coapted To anterior vag. fascia*	*Colles' fascia coapted To cervix*	*Not repaired*	*Totals*
None	1	23	1	0	3	2	0	30
Suspension or interposition	0	4	0	0	0	1	0	5
Hysterectomy								
Supracervical	0	6	1	0	1	1	0	9
Complete abdominal	0	2	1	0	4	0	2	9
Complete vaginal	0	2	4*	1	10*	0	4	21*
Totals	1	37	7*	1	18*	4	6	74*

*One operation included both fascia plastic repair and colpocleisis.

servation, a hernia through the lower posterior vaginal wall is always a rectocele, whereas primary enterocele always protrudes through the upper posterior vaginal wall, back of the cervix. The depth of the cul-de-sac bears no relation to it.

Of all the writers on the subject, Meigs appears to have had the clearest and most reasonable idea of the cause. It was his custom to explore the cul-de-sac digitally and visually when doing abdominal surgery. Often he found between the uterosacral ligaments a deep dimple, a small ring, or even a hernia sac which might be as long as a finger. These lesions he believed were potential or early enteroceles. In a few cases, he conceded, a deep cul-de-sac containing sigmoid or small intestine may present as a large rounded bulge on top of the rectum behind the posterior wall of the vagina. This might be called an enterocele, Meigs admitted, but in his view, the logical end result of a prolapse of the cul-de-sac is a prolapse of the anterior wall of the rectum through the anus or even a herniation into the perineal body, cases of which have been reported. Meigs, therefore, maintained that the true (primary) enterocele is a small, narrow, thin-walled sac, probably congenital, which forms directly behind the cervix and lies between the posterior vaginal wall and the anterior rectal wall in the rectovaginal septum. The sac has a small neck, is made up of very thin peritoneum, and contains small intestine. The cul-de-sac is below such hernias and is not connected with the enterocele.

This description conforms with our observations. In the course of abdominal surgery, we have found many a small sulcus in the upper cul-de-sac, just posterior to the cervix. These undoubtedly are incipient enteroceles, and we routinely explore for them and repair them.

An understanding of the true etiology of primary enteroceles is important, for we are sure that it will lead to observation and treatment of many early cases now overlooked. We find proof of this in our own experience. In the 4 years 1942 to 1945 we recorded 11 enteroceles, in the next 4 years 22, and in the succeeding 4 years 30. Ten were repaired in 1954. Obviously, greater familiarity with the condition leads to increased diagnoses and repairs.

CLASSIFICATION OF CASES

Our cases are summarized in Tables I to III, which are self-explanatory. The group of 35 enteroceles not preceded by hysterectomy were all posterior vaginal hernias.

TABLE II.—SIX CASES OF RECURRENT ENTEROCELE

Previous surgery	*Original enteroceles: Posterior vaginal hernia*	*Original enteroceles: Hernia through pelvic floor*	*Original enteroceles: Repairs*	*Recurrent enteroceles: Posterior vaginal hernia*	*Recurrent enteroceles: Hernia through pelvic floor*	*Recurrent enteroceles: Repairs: Colles'*	*Recurrent enteroceles: Repairs: None*
None	2	0	2 Perineorrhaphies	0	0	0	0
Hysterectomy							
Supracervical	2	0	2 Perineorrhaphies	0	0	0	0
Complete abdominal	0	1	1 Perineorrhaphy	0	1	0	1
Complete vaginal	1	0	1 Moschcowitz	5	0	3	2
Totals	5	1	6	5	1	3	3

TABLE III.—CLASSIFICATION OF ENTEROCELES BY AGE

Age span, yrs.	No prev. surg.	Susp. or interpos.	Prev. abdom. —hysterectomy— Pan.	Supra.	Prev. vag. —hysterectomy— Pan.	Supra.	Recurrences —following— Abd. pan.	Vag. pan.	Totals	Average age, yrs.
20–29	1	0	0	0	0	0	0	0	1	26
30–39	2	0	1	0	0	0	0	0	3	34
40–49	2	2	0	0	2	0	0	1	7	47
50–59	9	1	4	7	3	1	1	3	29	56
60–69	12	2	2	0	7	0	0	1	24	64
70–78	4	0	1	1	3	0	0	0	9	73
Totals	30	5	8	8	15	1	1	5	73	58½

Four of these patients had previously undergone uterine suspension, and 1 had had an interposition operation. Some surgeons believe that suspension predisposes to development of enterocele, and we are inclined to agree that both suspension and interposition may be incriminated.

In the 9 cases preceded by supracervical hysterectomy, all of the enteroceles were of primary type. One patient, aged 50 years, had undergone an abdominal supracervical hysterectomy 16 years before her enterocele repair and a salpingo-oophorectomy 6 years before. She came to us with a complete prolapse of the cervix and vagina and a very large primary type enterocele. Colpocleisis was the repair chosen because of her severe prolapse and our short experience at that time with the fascia plastic repair.

In the 29 cases preceded by panhysterectomy, the abdominal route had been employed in 9 and the vaginal route in 20. In this group, 16 enteroceles herniated through the posterior vaginal wall and 13 through the pelvic floor. Six enteroceles through the pelvic floor followed abdominal and 7 followed vaginal panhysterectomy, whereas 3 posterior vaginal hernias developed after abdominal hysterectomy and 13 after vaginal hysterectomy. Either route, therefore, seems equally at fault in development of secondary enteroceles. Primary enteroceles apparently are more easily overlooked from below than from above, and so more often develop after vaginal panhysterectomy.

Recurrent enteroceles (Table II) may be of the same type as the original enterocele, or one may be primary and the other secondary if the first repair was accompanied by a panhysterectomy. A true recurrence, however, should be of the same type as the primary hernia, even though panhysterectomy had preceded the recurrence. Ours were all true recurrences.

In one of these recurrent cases the first pelvic operation was a vaginal panhysterectomy, accompanied by cystourethrocele and rectocele repairs. Although an enterocele was not observed, the uterosacral ligaments were coapted. Five years later, in conjunction with repair of an umbilical hernia, a primary enterocele was repaired by the Moschcowitz technique, in which the culde-sac is closed to the sigmoid colon by placing successive purse-string sutures, starting at the base of the sac. Four months later the enterocele recurred and was successfully repaired by our fascia plastic technique.

Of the 73 enteroceles included in this study, 20 followed panhysterectomies performed by one of us. The remainder of the cases were either primary or followed surgery performed elsewhere.

OTHER CAUSATIVE FACTORS

Contributory etiologic factors generally agreed upon are: (1) the erect posture, (2) age, which weakens the tissues, and (3) childbirth injury, especially to the posterior vaginal tissues through which the enterocele herniates. This is suggested by the frequent association of enterocele with uterine prolapse, cystocele, and rectocele.

THE EFFECT OF MOTHERHOOD

We have studied our series with a view to correlating parity and the number and severity of the cases. The number of full term pregnancies in our series ranged from none to 9, and the number of births is unknown in 6

primary cases. The heaviest concentration of enteroceles was found in the groups with 1 to 4 full term deliveries. Of the 60 posterior vaginal hernias (primary type enteroceles) 17 were small, 26 moderate, and 17 large. In the secondary group of 13 enteroceles (herniations through the pelvic floor), 4 were of moderate size and 9 were large. The severity is somewhat greater in the secondary group, but this probably is related more to the preceding hysterectomies than to the parity. One difficult, traumatic childbirth may do more to produce enterocele than 9 normal, relatively easy deliveries. The fact remains, however, that it is mostly the mothers of children who have enteroceles. Conversely, most women over 30 are mothers. The connection may be more coincidental than etiologic, but it is worth noting that no unmarried women were among our enterocele patients.

THE ROLE OF AGE

Unquestionably age plays a part, as shown by Table III. The greatest number of enteroceles and the most severe enteroceles appear in the fifties and sixties, after the chemical changes of the climacteric have contributed to deterioration of the pelvic tissues. Primary enteroceles, however, appear at all ages. We have repaired one for a patient aged 26 years, and 4 for patients in their seventies. Enteroceles secondary to hysterectomy are found chiefly in the older years, but hysterectomies are deferred, when possible, until the procreative age is past. Four of our recurrent enteroceles developed during the fifties, and 1 each in the forties and sixties. They were not a disease of old age, suggesting that age may not play a leading role in recurrences.

THE "PROLAPSE SYNDROME"

One of the chief factors predisposing to enterocele, as well as to uterine prolapse, cystocele, and rectocele, is the quality of the pelvic tissues with which these patients are endowed. Women with these disabilities have fragile, friable tissues which are difficult to handle at operation without tearing. Such patients belong to a well defined group. Their history is characterized by multiple operations. In our series, surgery preceded enterocele repair for as much as 36 years, and in the majority of cases the interval was not less than 5 to 10 years. A total of 82 pelvic operations preceded enterocele repairs, and there were 131 concurrent surgical procedures. To date our 67 patients have had a total of 283 pelvic operations for uterine prolapse, cystocele, rectocele, and enterocele, an average of 4.23 per patient. These women may well be said to have a "prolapse syndrome."

VAGINAL HYSTERECTOMY INCRIMINATED

Vaginal hysterectomy is the predominant cause of subsequent enteroceles. Smead has noted that the Mayo type vaginal hysterectomy, in which the broad ligaments are brought together and fastened well under the symphysis, leaves a weak place in the cul-de-sac unless steps are taken to avoid it. Counseller agrees that this is true unless the uterosacral ligaments are brought together as close as possible over the sigmoid. If the vagina is not shortened, he points out, recurrence is likely. Kennedy and Phaneuf recommend that vaginal hysterectomy be carried out by the clamp method, claiming that this causes retraction of the vaginal fornix, and so is not followed by postoperative enterocele. It is generally accepted that the greatest care should be taken in closing the ligaments securely to prevent herniation through the pelvic floor. The authors concur in the opinion that the Mayo type vaginal hysterectomy is not anatomic.

Our study shows that complete hysterectomy frequently is followed by a primary type of enterocele. This finding attests the wisdom of exploring the cul-de-sac for incipient hernias which may be precipitated by the operation.

TECHNIQUES FOR ENTEROCELE REPAIR

The classical methods for repair of enteroceles include the following: (1) closure and

obliteration of the enterocele sac by techniques which vary only in details; (2) closure of the uterosacral ligaments as far back toward the sigmoid as possible; (3) closure of the cul-de-sac of Douglas by means of successive purse-string sutures, starting at the base of the sac, as first proposed by Moschcowitz for cure of rectal prolapse; (4) high perineorrhaphy by variations of the method first described by George Gray Ward; (5) colpocleisis, total or partial, for intractable cases in elderly patients.

For herniation through the vaginal vault after panhysterectomy, Te Linde urges that all available ligaments be brought together and sutured to the vagina to give support and also to close the hernia defect.

Hiller closes the uterosacral ligaments and attaches them to the coapted cardinal ligaments, leaving the sutures long. These are subsequently attached to the levator ani muscles, completely obliterating the hernia opening.

Harrison and McDonagh recommend placing a crown suture in the upper posterior vaginal fascia which makes fast to the cervix a ring of plicated (and therefore strengthened) musculofascial tissue. They further plicate all redundant tissue to the weakened supporting structure of the posterior vaginal wall.

Parsons and Ulfelder recommend a combined vaginal and abdominal repair, closing the sac and doing a perineorrhaphy from below, then closing the uterosacrals from above, incorporating the sac in the closure. For vaginal prolapse after panhysterectomy they first do a cystocele repair, then a strip of rectus fascia is developed on each side of the midline. The abdomen is opened, the round ligaments are divided, and the corners of the vaginal stump are exposed. A half length of rectus fascia is passed along the course of each round ligament. A suture is drawn through the peritoneal tunnel on each side and fastened to the wall of the vaginal apex. The remains of the round ligaments are imbricated over the posterior vaginal wall.

Reed crosses the uterosacral ligaments, suturing each to the broad ligament of the opposite side, and carefully closing the small posterior hiatus.

TECHNIQUES USED IN THE PRESENT SERIES

We have used all of the classical types of enterocele repair, and Table I speaks for itself. Obliteration of the sac, of course, is a prerequisite for any type of operation, and we do this routinely, closing it from within by means of a purse-string suture, ligating it from without, and amputating the redundant portion. Some writers have considered this sufficient to control enterocele, but obviously it cannot guarantee a permanent repair unless the defect through which the hernia emerges is also closed effectively.

Of our 6 recurrences, 5 followed perineorrhaphy, which, as we see it now, is not an enterocele repair at all, however well it may control rectocele. The enterocele emerges above the rectocele, and, although restrained temporarily, it may reappear, rolling down over the site of the repaired rectocele. In 2 of these cases the uterosacral ligaments were also closed, but this did not prevent recurrence. The sixth recurrence followed the lone Moschcowitz repair and effectively discouraged further experimentation along that line.

We believe it is useless to rely on closure of the cul-de-sac or the uterosacral ligaments for correction of enterocele. The cul-de-sac is lined with peritoneum and the ligaments often are not much more than folds of peritoneum. It is improbable that suturing these serous peritoneal surfaces together will induce them to unite. Any deterrent effect of this procedure, therefore, must be dependent on the continued support of permanent sutures. These, however, easily tear out of the fragile supporting tissues usually present in enterocele cases and are not reliable.

Colpocleisis is an effective method of repair, but no matter how old a woman may be, she dislikes it, and it is an operation we are loath to do. Our fascia plastic repair is a good substitute, if not indeed a better

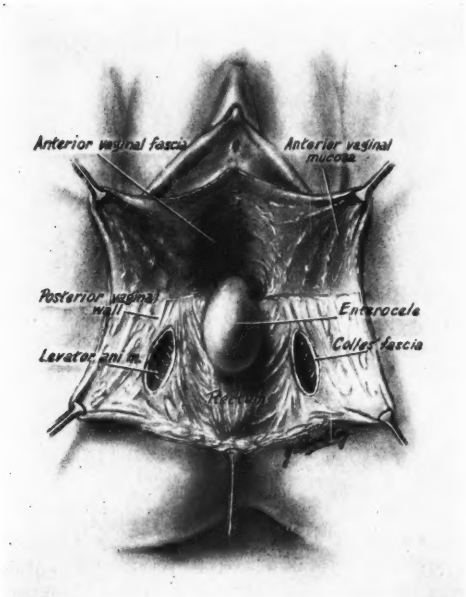

FIG. 1. The fascia of the anterior vaginal wall (pubocervical fascia) has been coapted, as in the usual repair of cystocele. The mucosa of the anterior wall, separated from the fascia, is widely retracted to give a clear view of the operative tract. The uterus has been completely removed. The posterior vaginal wall (mucosa and fascia in a single layer) is retracted, uncovering the primary type enterocele which protrudes through a defect high in the cul-de-sac of Douglas. Also shown are the 2 incisions through the superficial and Colles' fascia and the urogenital diaphragm up to the pubococcygeus muscle.

method of repair. It is particularly applicable to herniations through the pelvic floor, especially when there is little or no support from the cardinal ligaments. We now use it routinely in such cases, and also for repair of large primary type enteroceles, especially those following complete hysterectomy. For moderate or small primary enteroceles, closure of the sac often is sufficient, although we sometimes prefer to use the fascia plastic.

This technique prevents herniation through the vagina by uniting the Colles' fascia with the anterior vaginal fascia (pubocervical fascia) at the vaginal vault. It leaves a functioning vagina with a depth of 2½ to 3½ inches. In cases in which the uterus is intact and well supported, we have attached the Colles' fascia high on the posterior aspect of the cervix. This also closes the vagina securely against posterior herniations, but it would not prevent conception, and doubtless childbirth would wreck the enterocele repair. Such patients should be delivered by cesarean section. We have used the technique, also, when only the cervix remained, provided its support seemed adequate, but recently 2 of these patients have returned with prolapse of the cervix. We recommend, therefore, that the cervix be completely removed before the enterocele repair is started.

Our first fascia plastic operation was done in March 1948 for a small primary hernia. At the time we failed to recognize the peculiar value of the procedure and did not use it again until April 1950 for repair of an enterocele through the vaginal vault. Even then, we had so little faith in the technique that we supplemented it with a colpocleisis. More than a year passed before we made a third trial in June 1951. Three repairs were done by this method in 1952, when we began really to appreciate it. In 1953 we used it for 5 of 7 enteroceles, 1 of these by attachment to the cervix. In 1954 it was used for all 10 of our enteroceles. Altogether the fascia plastic repair has been used for a total of 21 enteroceles. The technique is not exceptionally difficult, and the operation is entirely a vaginal procedure. In essence, it is an extension of the George Gray Ward perineorrhaphy.

The time since we started developing the operation is too short, and the cases too few to permit a final evaluation of the procedure. To date the results have been very encouraging. There have been no recurrent enteroceles, and the only unfavorable results have been prolapse of the cervix in 2 cases.

THE FASCIA PLASTIC TECHNIQUE

The usual anterior colporrhaphy incision is made through the anterior wall of the vagina from just beneath the urethra to the vault, and the musculofascial layer (pubocervical or pubovesical fascia) is separated from the mucosa. Redundant fascia is

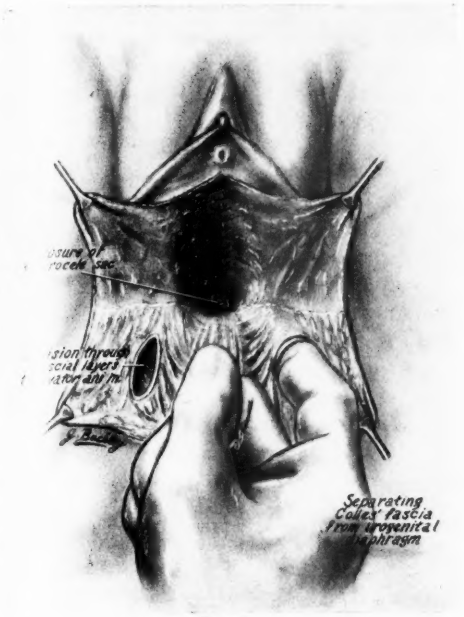

FIG. 2.

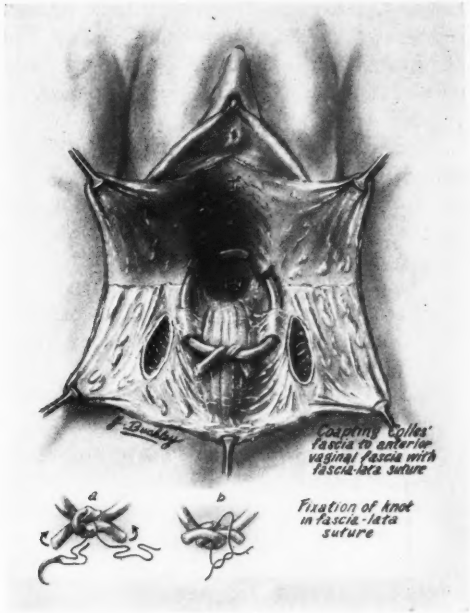

FIG. 3.

FIG. 2. The small intestine has been pushed back through the defect by which it emerged, and the peritoneal sac has been closed from within and without and amputated. The dissecting finger is shown separating the Colles' fascia from the urogenital diaphragm as far up as possible.

FIG. 3. A fascia lata suture has been used to coapt the superficial and Colles' fascia in one layer to the anterior vaginal fascia at the vault of the vagina. This suture will be drawn up tight and tied, and the knot will be fixed as shown in the small drawings. This procedure completely closes the vagina against a second descent of the enterocele. Another fascia lata suture will be used to coapt the levator ani muscles after they are drawn through the lateral incisions. The perineorrhaphy will then be completed as usual. Redundant mucosa will be trimmed off, and the anterior and posterior vaginal mucosa will be closed. The postoperative depth of the vagina varies from 2½ to 3½ inches.

trimmed from the margins, the fascia on the bladder is imbricated if necessary, and the anterior vaginal fascia is closed as in the usual repair of cystourethrocele. The mucosa is not closed at this time, and, if desired, the fascia also may be left open until later.

A posterior colporrhaphy is then begun with a transverse incision along the mucocutaneous junction. A longitudinal incision is next made in the posterior vaginal wall from the mucocutaneous junction to the vaginal vault. The mucosa and fascia are not separated, but the entire vaginal wall is freed from the underlying rectal fascia and is retracted laterally (Fig. 1).

The enterocele sac is defined, opened, closed from within with a purse-string suture, ligated from without, and amputated.

The usual lateral incisions of the George Gray Ward perineorrhaphy are made by inserting curved Mayo scissors (blades closed) obliquely through the superficial and Colles' fascia and the urogenital diaphragm up to the level of the pubococcygeus muscle. To enlarge the incision, the scissors are withdrawn with the blades open. A gloved finger is inserted through first one and then the other of these incisions between the Colles' fascia and the urogenital diaphragm, and the Colles' fascia is separated by blunt dissection from the diaphragm as far up as possible (Fig. 2).

The superficial and Colles' fascia in one layer are drawn upward and attached to the anterior vaginal fascia (pubocervical fascia) at the vault with one or two fascia lata su-

tures, closing the vagina securely against descent of the small intestine (Fig. 3). The anterior repair is then completed by closure of the mucosa, followed by completion of the perineorrhaphy.

The essential features of our fascia plastic procedure are: (1) the complete bisection of the vaginal wall, anterior and posterior, and separation of the anterior fascia from the mucosa; (2) the separation of the Colles' fascia from the urogenital diaphragm as high up as possible; (3) the attachment of the Colles' and superficial fasciae in a single layer to the anterior vaginal fascia at the vault; (4) the use of fascia lata sutures to coapt the Colles' fascia and the anterior vaginal fascia.

By this procedure the two layers of superficial and Colles' fascia which normally encircle the vagina are drawn across the vagina from posterior to anterior, closing it completely at a fairly high level, yet preserving a functional organ.

We prefer fascia lata sutures because they are less apt to pull out than other sutures and are more comfortable. They become integrated into the fascia tissues which they coapt, and so form a permanent part of the repair.

SUMMARY

Analysis of a series of 73 enteroceles seen, in the past 12 years shows that repair by closure of the sac and high perineorrhaphy was followed by 5 recurrences, and a sixth recurrence followed repair by the Moschcowitz procedure. No recurrences followed colpocleisis, but this method is not suitable for young, sexually active women, and it is disliked by women of all ages.

A new technique for repair is described in which the superficial and Colles' fascia in one layer are coapted at the vaginal vault to the fascia of the anterior vaginal wall (the pubocervical or pubovesical fascia), using fascia lata sutures. This technique completely closes the vagina against descent of small intestine, yet leaves a functioning organ of sufficient depth and caliber. The procedure is equally suitable for herniations through the pelvic floor and large enteroceles through the posterior vaginal wall. It can also be adapted to the needs of the patient with moderate or small primary enterocele. The operation was first done in 1948, and has been used in 21 cases, with good results to date. The authors believe it is the answer to the vexing problem of lasting enterocele repair.

REFERENCES

1. Counseller. Discussion of Phaneuf (9).
2. Folger. Discussion of Weed and Tyrone (15).
3. Harrison, J. E., and McDonagh, J. E. Hernia of Douglas' pouch and high rectocele. Am. J. Obst. Gyn., 1950, 60: 83–92.
4. Hiller, Robert I. Repair of enterocele with preservation of the vagina. Am. J. Obst. Gyn., 1952, 64: 409–412.
5. Kennedy. Discussion of Phaneuf (9).
6. Meigs, Joe Vincent. Enterocele, or posterior vaginal hernia. Surg. Clin. N. America, 1947, October, pp. 1226–1230.
7. Moschcowitz, Alexis V. The pathogenesis, anatomy, and cure of prolapse of the rectum. Surg. Gyn. Obst., 1912, 15: 7.
8. Parsons and Ulfelder. Atlas of Pelvic Operations. Pp. 152–153 and 155. Philadelphia and London: W. B. Saunders Co., 1953.
9. Phaneuf, Louis E. Posterior vaginal enterocele. Am. J. Obst. Gyn., 1943, 45: 490–496.
10. Idem. Posterior vaginal enterocele (hernia of cul-de-sac of Douglas); study based on 91 private patients. Obst. Gyn., 1953, 1: 257–262.
11. Reed, Charles D. Enterocele. Am. J. Obst. Gyn., 1951, 62: 743–757.
12. Smead. Discussion of Phaneuf (9).
13. Te Linde, Richard W. Enterocele. Pp. 241–246. Operative Gynecology. 2nd ed. Philadelphia, London, Montreal: J. B. Lippincott Co., 1953.
14. Ward, George Gray. The operative technique for the repair of rectocele and injury to the pelvic floor. Surg. Gyn. Obst., 1929, 48: 399–403.
15. Weed, J. C., and Tyrone, C. Enterocele; an analysis of 52 cases. Am. J. Obst. Gyn., 1950, 60: 324–332.

THE EXPERIMENTAL PRODUCTION OF GRADED AORTIC INSUFFICIENCY

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OPERATIONS for the experimental production of aortic insufficiency have been described for over 80 years. Of the methods devised, few have combined technical simplicity and low operative mortality with the production of a predictable degree of chronic aortic incompetence. The present method was developed in order to provide experimental animals suitable for prolonged physiologic study and the assessment of surgical procedures devised for the treatment of aortic insufficiency in patients.

An instrument has been designed to selectively engage an aortic cusp and cut from its base a circular defect of predetermined size. The instrument is introduced through an incision in the ascending aorta and the procedure is carried out during a brief period of inflow occlusion. The aortic incision is then closed while excluded by a clamp as venous return is gradually resumed.

METHOD

The aortic leaflet punch is illustrated in Figure 1. It consists of two telescoping stainless steel tubes; the outer tube has a smooth blunt tip while the inner or cutting tube has a bevelled cutting edge which projects 2 millimeters beyond the outer tube when it is in the extended or cutting position. A polyethylene tube and stopcock are attached to the base of the cutting tube to provide suction. Instruments were constructed with inner tubes of 2.1, 2.8, 3.9, and 6.4 millimeter diameter.

Fasting dogs, weighing 6 to 18 kilograms are anesthetized with intravenous pentothal and positioned for a right thoracotomy. A superficial femoral artery is cannulated and the initial arterial pressure recorded by means of a Statham transducer and direct recorder. The chest is entered through the third right intercostal space and respirations maintained with oxygen administered through an endotracheal tube attached to a demand valve. The pericardium is opened anterior and parallel to the phrenic nerve and retracted with a suture. The right atrial appendage is retracted inferiorly by a ligature at its tip. Two No. 5-0 silk sutures are placed vertically, 7 to 10 millimeters apart, in the adventitia of the anterior wall of the aorta 15 to 25 millimeters above the valve ring. Temporary traction ligatures of heavy silk are placed around the superior and inferior venae cavae and the azygos vein. Total venous inflow is then occluded by traction on the ligatures. Twenty to 30 seconds are allowed for emptying of the heart. A short vertical incision is then made through the wall of the aorta between the guide sutures

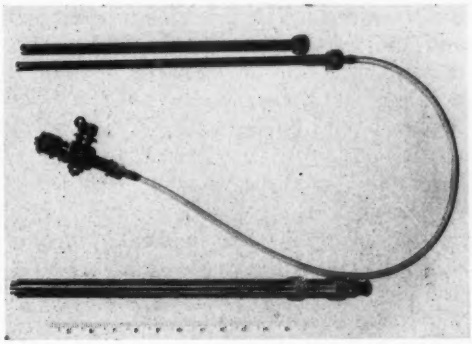

FIG. 1. The aortic leaflet punch. Above, the instrument is disengaged to show the outer tube with its smooth blunt tip, and the inner tube with 3.9 millimeter diameter cutting edge. Polyethylene tubing connects the inner sheath to suction by way of a stopcock. Below, the instrument is fully engaged, with 6.4 millimeter cutting edge projecting.

From the Clinic of Surgery, National Heart Institute, Bethesda, Maryland.

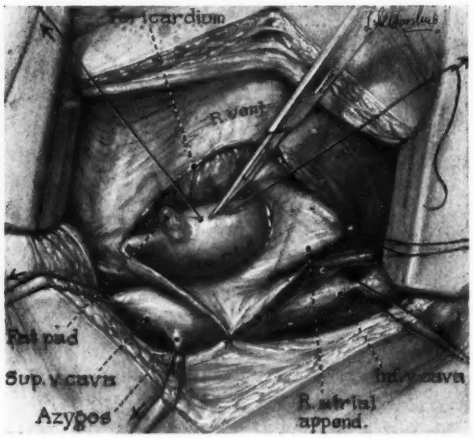

FIG. 2. Two No. 5-0 silk sutures are placed vertically in the adventitia of the ascending aorta. Total venous inflow is occluded by traction on temporary ligatures around both cavae and azygos vein. A short incision is made through the aortic wall between the guide sutures.

(Fig. 2). The aortic leaflet punch is then insinuated into the aorta and guided by palpation until the blunt outer sheath engages the desired cusp of the aortic valve (Fig. 3). The stopcock is opened and the inner sheath with its sharp cutting edge is sucked rapidly against the engaged cusp. It is gently rotated and cuts out a disc of tissue at the base of the cusp (Fig. 4). Blood is seen being sucked into the tubing, at which time suction is discontinued. The instrument is removed and the aorta partially clamped with a Beck aortic clamp so as to exclude the incision and yet allow continuity of flow. Traction on the occluding caval ligatures is gradually released, first the superior, then the inferior, and later the azygos. As shown by Andreasen, it is important to restore inflow slowly, while observing the heart, since too rapid release of the ligatures may lead to overloading of the heart and acute failure. The period of total occlusion varies between 1 and 2 minutes. The incision in the aorta is closed with No. 5-0 silk guide sutures by means of a continuous over and over suture (Fig. 5). Any bleeding after removal of the Beck clamp is readily controlled by 1 or 2 minutes of pressure. A diastolic thrill is immediately palpable over the outflow tract of the left ventricle. The chest is closed in layers.

Fifteen minutes after the resumption of spontaneous respirations, a postoperative femoral arterial pressure is recorded. The dog is given 600,000 units of aqueous procaine penicillin as prophylaxis. None of the animals in this experiment has been digitalized and their activities have not been limited.

RESULTS

Aortic insufficiency was produced in 46 dogs. Defects from 2.1 to 6.4 millimeters in diameter were produced. The right coronary cusp was perforated in every dog, and in 9 the left coronary cusp in addition. The size and number of defects and their relation to survival are summarized in Table I. The noncoronary cusp was deliberately not injured in this experiment. There were 2 operative deaths (4.4 per cent); 5 dogs (10.9 per cent) died within the first 24 hours from acute congestive failure and pulmonary edema was present at autopsy. There were 35 chronic survivors (76 per cent).

Immediately following operation all dogs displayed the classic signs of aortic insuffi-

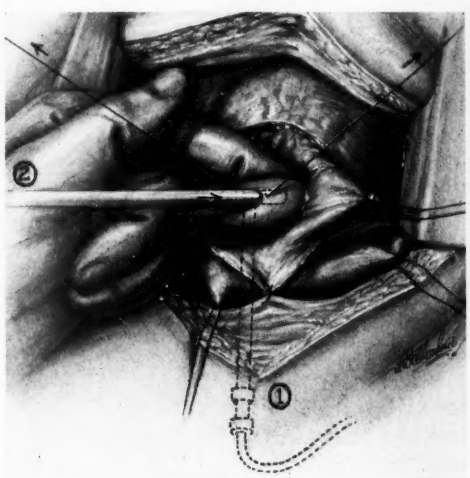

FIG. 3. The aortic leaflet punch is insinuated into the aorta, and guided by palpation into any desired cusp.

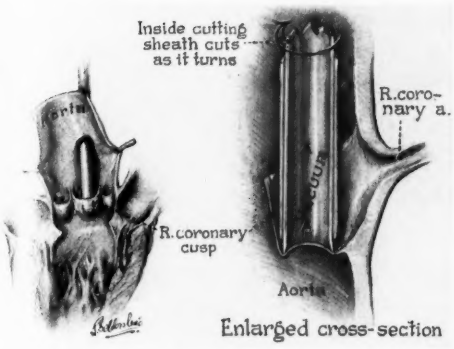

Fig. 4. The outflow tract of the left ventricle is opened to illustrate the instrument engaging the right coronary cusp. When suction is applied, the cutting edge of the inner sheath is sucked against the engaged cusp; with rotation it cuts out a disc of tissue.

ciency: bounding peripheral pulses, pistol-shot sounds, and a Duroziez's murmur in the compressed femoral artery. A decrescendo diastolic murmur was easily heard over the base of the heart, and was well transmitted over the left chest.

In all 44 dogs surviving operation, there was marked widening of the pulse pressure in the femoral artery, varying with the weight of the dog, size, and number of defects (Fig. 6). Mean pressure, as determined by planimetric integration, fell significantly in every dog. Femoral artery pressure was again measured under the original conditions in 23 animals at varying periods after operation. It is noteworthy that 43.5 per cent showed a further widening of pulse pressure; 26 per cent showed no change (plus or minus 10 mm. Hg), while 30.5 per cent showed some narrowing.

Thirteen of the dogs were used in a valve prosthesis experiment; these animals had aortic insufficiency for from 2 hours to 82 days before the second operation. Thirteen of the dogs (chronic survivors) died spontaneously and at autopsy showed evidence of congestive heart failure with pulmonary and hepatic congestion. All of the animals that have come to autopsy have shown gross left ventricular hypertrophy. In 2 of the dogs there was evidence of healed bacterial endocarditis, with calcified vegetations around the edge of the cusp defect. The defects in the aortic cusps were patent in all dogs examined at autopsy (Fig. 7). All survivors have maintained the physical signs of aortic insufficiency. Detailed anatomic and physiologic studies of these animals are in progress.

The important factors in determining pulse pressure increases and mean pressure fall seem to be animal weight and the number of cusp defects. The size of the defect (between 2.8 and 6.4 mm.) appears less critical. To produce moderate regurgitation compatible with long survival, a single 3.9 millimeter defect in dogs of 9 to 16 kilograms seems most suitable.

DISCUSSION

In 1872 Becker first produced aortic insufficiency by passing a glass rod down the dog's carotid artery. Rosenbach in 1878 ruptured aortic cusps by passing a sound down the right carotid, and in 1906 MacCallum modified the technique by using a blunt hook with an inner concave cutting edge. Hermann in 1926 used the same technique in 150 dogs. Of these, only half had typical signs of aortic incompetence. There was no uniformity among the lesions produced.

The transventricular approach for production of chronic aortic insufficiency was first undertaken in 1952 by Lam. He used a

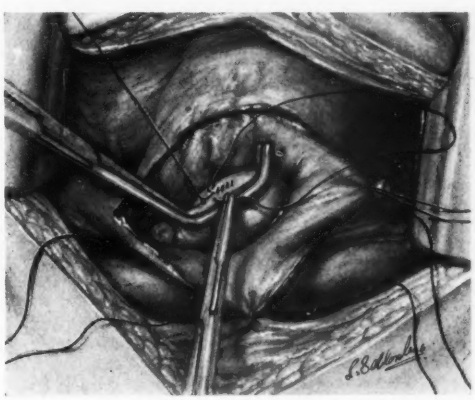

Fig. 5. A Beck aortic clamp excludes the incision which is sutured after venous return is gradually resumed.

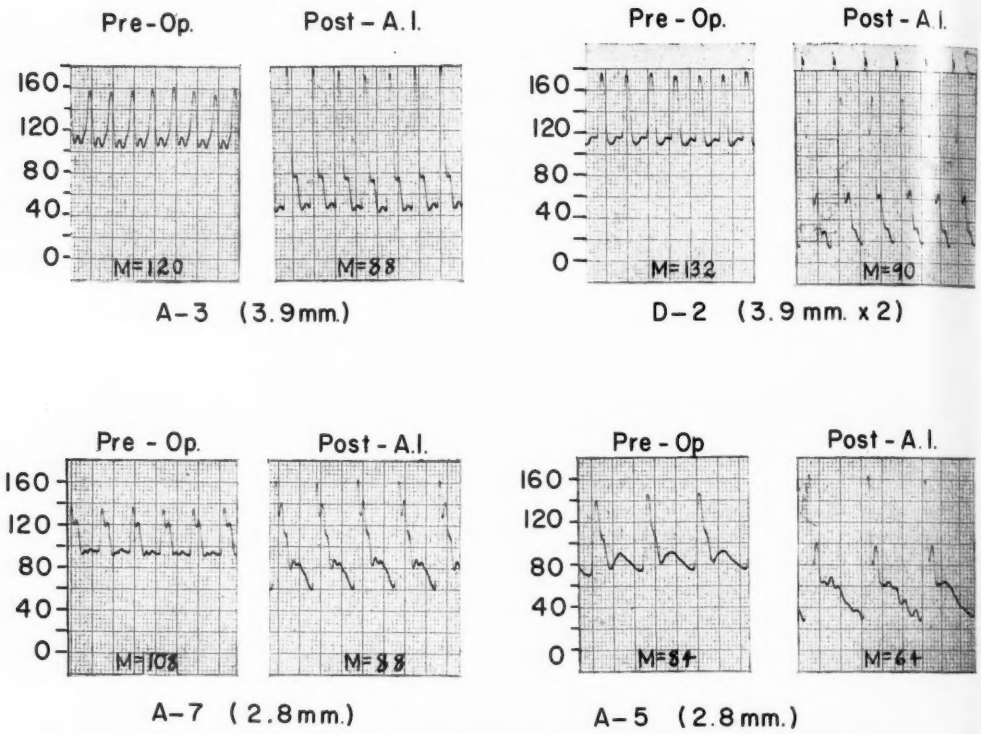

FIG. 6. Femoral arterial tracings taken before and after the production of aortic insufficiency. (Pressures in millimeters of mercury. Paper speed 25 mm. per second.) Animal number and amount of cusp tissue removed are indicated. M = mean pressure.

transventricular valvulotome "which could be pushed through the wall of the left ventricle to produce a rather uniform cut in one or more aortic valve cusps. Usually, only the posterior cusp was incised, to avoid disturbance of coronary artery blood flow." The operative mortality was 20 per cent in 32 dogs. After 1 month he noted disappearance of physiologic evidence of aortic insufficiency. In 1954 Alai described a "backward cutting punch" introduced into the apex of the left ventricle which cut out a portion of the noncoronary cusp at its edge. Hawthorne has recently described "subtotal aortic valvulectomy"; his approach is through the ventricle with an instrument that removes a crescent-shaped piece of the free edge of the noncoronary cusp. All of these dogs require preoperative digitalization and none has survived removal of a portion of either coronary cusp.

TABLE I.—AORTIC INSUFFICIENCY PRODUCED IN 46 DOGS

Lesions, diameter (mm.)	*No. of dogs*	*Acute deaths (<24 hrs.)*	*Subacute deaths (<7 days)*	*Chronic survival (7+days)*
2.1	1	0		1
2.8	8	1		7
2.8×2 (2 cusps)	1	0		1
2.8×2 (same cusp)	1	0		1
3.9	22	3*	3*	16
3.9×2 (2 cusps)	9†	0		7
3.9×2 (same cusp)	2	1		1
6.4	2	0	1	1
Total: No.	46	5	4	35
Per cent		10.9	8.9	76

*Including 1 animal used for valve prosthesis experiment.
†Including the 2 operative deaths.

The transaortic approach to the aortic valve was used by Smithy and Parker in 1947 in considering the treatment of clinical aortic

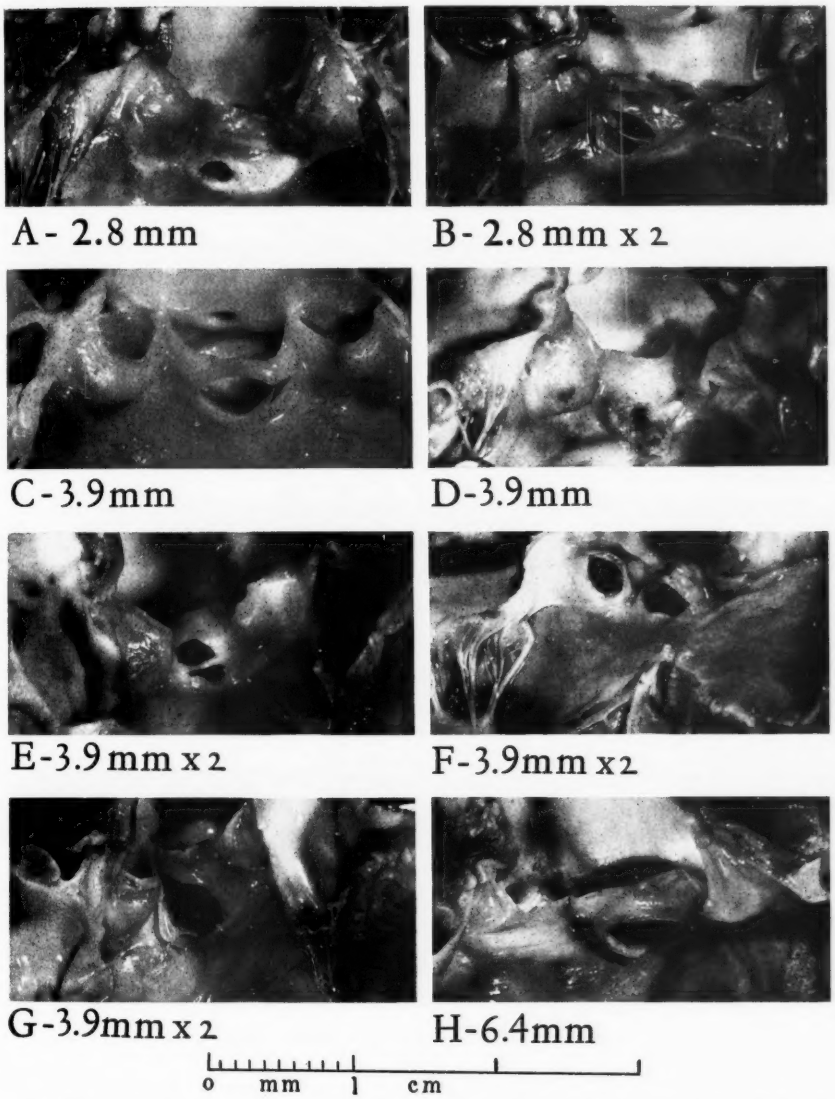

FIG. 7. A composite of the aortic valve area in formalin-fixed hearts of dogs with acute and chronic aortic regurgitation. The cutting diameter of the aortic leaflet punch used in each case is indicated. A, Dog 3. Duration of lesion is 3 months. There is thickening at edge of defect. B, Dog 7. Duration of lesion is 39 days. Two lesions were produced in the right coronary cusp, separated by a band of cusp tissue. C, Dog F-1. An acute lesion. D, Dog D-4. Duration of lesion 5 weeks. Verruca-like calcified endocarditic vegetations are seen around the edge of the defect. E, Dog C-2. Duration of lesion 27 days. Two defects in right coronary cusp are separated by a band of cusp tissue. F, Dog D-5. Pulmonary edema 9 days following surgery. There are identical lesions in the right and left coronary cusps. G, Dog B-3. An acute lesion. An attempt to produce two defects in the right coronary cusp resulted in free regurgitation due to overlapping of the lesions. The absence of a protective band of cusp tissue as seen in B and E is conspicuous. H, Dog F-5. A 4 day subacute lesion.

stenosis. Their instrument consisted of a barbed blade at the end of a long brass handle. It produced an unpredictable lesion; the cusp was either divided, perforated, or lacerated, and on occasion partially avulsed. The method was abandoned because of high mortality (37 per cent) mainly due to uncontrollable hemorrhage from the aortic wound.

It is apparent from the above résumé that lesions of the aortic valve produced via the ventricle or a peripheral artery are unpredictable as to shape, position, and extent of injury. The supravalvular approach permits selective excision of tissue from one or more leaflets. There is no evidence that, in the period of observation, defects produced by this method have healed. Several authors describing the transventricular approach agree that incompetence of a coronary cusp is incompatible with survival. With the aortic leaflet punch coronary cusp lesions were produced with impunity. The transventricular methods involve removal of tissue from the free edge of the cusp which perhaps makes the lesion more lethal. The principal advantage of the method described is the relative precision with which varying degrees of incompetence can be produced. The chief factors determining the degree of incompetence are the weight of the dog and the amount of cusp tissue removed.

SUMMARY

An operation is described for the controlled production of experimental aortic insufficiency. Discs of tissue were excised from the base of one or more aortic leaflets by means of an aortic leaflet punch. The instrument was introduced via the ascending aorta during a brief period of inflow occlusion. Lesions were produced in one or both coronary cusps of 46 dogs. Operative mortality was 4 per cent. There was no evidence of healing and the chronic survival rate was high. The principal factor in determining the degree of incompetence was the amount of tissue removed in relation to body weight.

REFERENCES

1. Alai, J., Adam, A., Veri, F., and Jamison, W. L. Production of aortic insufficiency with a study of arterial tracings. Surgery, 1954, 36: 237–242.
2. Andreasen, A. T., and Watson, F. Experimental cardiovascular surgery. Discussion of results so far obtained and report on experiments concerning a donor circulation. Brit. J. Surg., 1953, 41: 195–206.
3. Becker, O. Ueber die sichtbaren Erscheinungen der Blutbeweguneg in der Menschlichen Netzhaut. Arch. Ophth., Berl., 1872, 18 Sect. 1: 206.
4. Hawthorne, E. W. Personal communication.
5. Hermann, G. R. Experimental heart disease. Am. Heart J., 1926, 1: 485–507.
6. Lam, C. R., Hartley, H. A., and Munnell, E. R. An experimental study of aortic valve homografts. Surg. Gyn. Obst., 1952, 94: 129–135.
7. MacCallum, W. G. On the teaching of pathological physiology. Bull. Johns Hopkins Hosp., 1906, 17: 251–254.
8. Rosenbach, O. Ueber artificielle Herzklappenfehler. Arch. exp. Path., Lpz., 1878, 9: 1–30.
9. Smithy, H. G., and Parker, E. F. Experimental aortic valvulotomy. Surg. Gyn. Obst., 1947, 84: 625.

ESTROGEN IN BONE REPAIR

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THE INFLUENCE of estrogenic substances upon the growth of new bone is not well understood and reports of experimental investigations of the subject have been contradictory. Moreover, it appears that the subject has not been extensively studied from the standpoint of the repair after fracture.

It has previously been shown that in young growing animals the effects of estrogen are an increase of endosteal bone formation and an interference with epiphyseal growth by disturbing the normal process of cartilaginous proliferation. In addition, the changes of advancing age are accelerated by premature narrowing of the epiphyseal plate and ossification of the medullary cavity and marrow spaces.

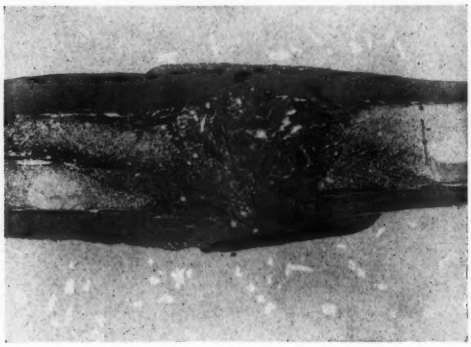
Silberberg and Silberberg (6) and Miller and his associates studied the separate and combined effects of estrogen and anterior pituitrin upon osteoblastic activity in growing mice. When administered separately these two hormones exerted opposing influences, but when combined there was a synergistic action with the inhibiting influence of the estrogen predominating. This effect of estrogen appeared to be directly upon the skeletal tissues rather than by mediation of the anterior pituitary. McKeown and associates and Silberberg and Silberberg (5) reported that in castrated animals estrogen exerted an early decrease with a later stimulation of callus formation.

Clinical observations indicate that both estrogens and androgens are of value in correcting postmenopausal or senile osteoporosis, including instances complicated by fracture or other skeletal diseases.

In view of the confusion which has resulted from experimental work upon laboratory animals as well as the suggestion of a possible clinical application to cases of trauma or operations upon bone, it has seemed advisable to investigate the subject further. These studies are concerned with the influence of the administration of an estrogenic substance upon the healing of experimentally produced fractures in both normal and castrated female rabbits. The work of Urist and McLean indicated that diethylstilbestrol is one of the most potent of all the synthetic estrogens in stimulating the production of endosteal bone. This hormone, therefore, was chosen and its influence upon bone formation at a fracture site investigated. An attempt has also been made to correlate the histologic picture of bone repair with levels of osteoblastic activity at the fracture site.

PROCEDURE

Female rabbits, weighing approximately 8 pounds each and approximately 6 months of age, were used. These animals had previously borne litters and were isolated in the laboratory from male rabbits during the experiments. They were fed a standard diet. Bilateral oophorectomy was performed under local anesthesia on 10 of these rabbits, a second group of 10 serving as controls. At a minimum of 2 months after castration, bilateral fractures of the radii were done on these animals under sterile technique using local anesthesia. The ulna was left intact, serving as an internal splint and obviating the use of external immobilization. One half of the rabbits in each of the control and castrated groups were given 1 milligram of diethylstilbestrol in Persic oil 3 times weekly beginning immediately following fracture. We, therefore, had 4 groups of 5 rabbits each. Group A consisted of normal controls which did not receive stilbestrol. The animals in group B



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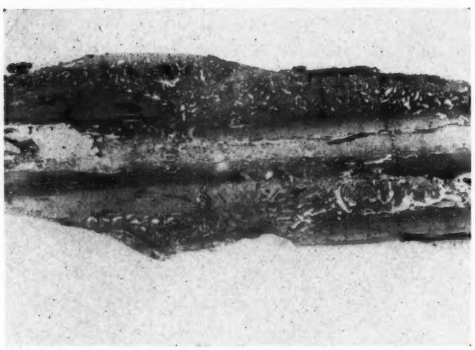

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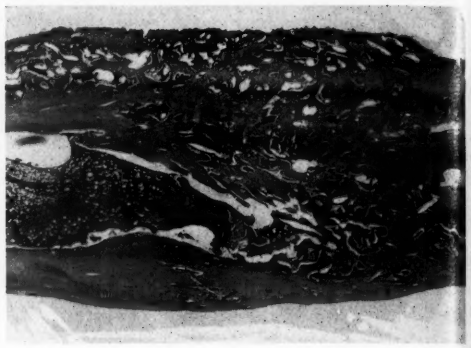


c

FIG. 1. a, Group A animal at 14 days; b, at 21 days; c, at 35 days.

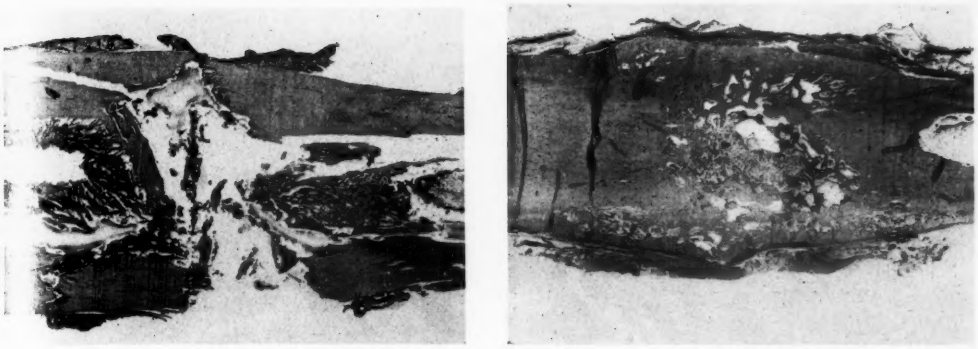
were castrated but did not receive stilbestrol. Group C consisted of normal rabbits which received stilbestrol, and group D of castrated rabbits which received stilbestrol. One rabbit from each group was sacrificed at 7, 14, 21, 35, and 49 days respectively following fractures. On the day of sacrifice, a roentgenogram of one of the fractured radii was taken and this same bone was studied microscopically. Bone phosphatase determinations were done upon the opposite fractured radius. For this determination a block of bone extending 1 centimeter on each side of the fracture site was removed, carefully weighed, ground, and extracted with a constant quantity of water for 48 hours, using the technique described by Botterell and King. The bone phosphatase levels were determined by the lumitron technique with a standard photoelectric colorimeter and the results expressed in Bodansky units per gram of bone.

OBSERVATIONS

In group A, the normal control rabbits which received no estrogen, an abundance of cartilage and osteoblastic activity was seen microscopically at 7 days. At 14 days (Fig. 1a) the cortices were almost re-established. Almost complete union of the fracture was evident at 21 days (Fig. 1b), and definite and complete bony union of the fracture was present at 35 days (Fig. 1c).

In group B, the castrated animals which received no estrogens, new bone trabeculation, a well formed osteoid mass and absence of cartilage cells were the outstanding findings at 7 days (Fig. 2a). At 14 and 21 days, this group of fractures showed relatively slow healing, with meager callus formation and very little osteoid activity. At 35 days, essentially complete union was present, but seemed to be slightly less uniform than in the corresponding rabbit in group A.

In group C, the control rabbits which received estrogens, there was very little osteoblastic activity at 7 days; but at 14 days, a massive amount of cartilage bridged both cortices at the fracture site. A 21 day determination was not obtained because 1 of the animals died of unknown cause at 19 days after fracture. There was a persistence of a small amount of cartilage and osteoid in the medullary cavity at 35 days. In spite of complete union of the fracture site at 49 days, the medullary cavity was obliterated by endos-



a b

FIG. 2. a, Group B animal at 7 days. b, Group C animal at 49 days.

l bone formation on both sides of the cture defect (Fig. 2b), and a large bridging llus, essentially completely calcified, was l present.

In group D, the castrated rabbits which re- ived estrogens, an organizing hematoma as present at 7 days, but there was little vidence of osteoblastic activity and no car- lage cells were visible. There was only minimal early cartilage and fibrous tissue in the fracture site at 14 days (Fig. 3a); but at 21 days, the microscopic section revealed an excess amount of embryonic cartilage bridging the fracture, numerous poorly formed trabeculae, abundant osteoblasts, and a moderate amount of osteoid and fibrous tissue (Fig. 3b). Delay in bone repair was conspicuous at 35 days (Fig. 3c) with excessive callus at the fracture site and obliteration of the medullary cavity by endosteal new bone formation.

PHOSPHATASE OBSERVATIONS

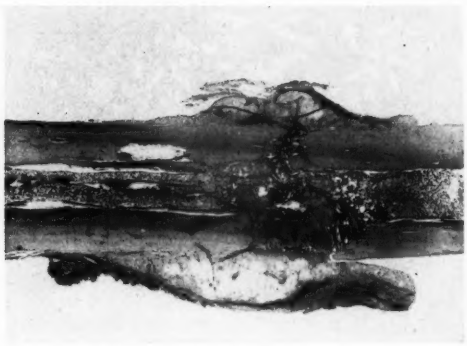
The phosphatase levels obtained in the 4 groups of animals are shown in Figure 5. It is to be noted that castration appears to eliminate the phase of increased phosphatase activity which occurs about the fourteenth day after fracture in uncastrated animals. These castrated animals, with or without estrogen therapy, show a sustained depression of phosphatase activity. The influence of estrogen is manifested by the fact that the phosphatase activity curves for all animals receiving stilbestrol lie well below those of corresponding untreated animals. This is true even in comparing the curves of normal untreated control animals with those which were castrated and thereby deprived of their physiologic supply of estrogen.

DISCUSSION

In this experiment the effects of estrogen administration on bone repair were determined, and it was found that estrogen delayed the healing of fractures in both castrated and control female rabbits.

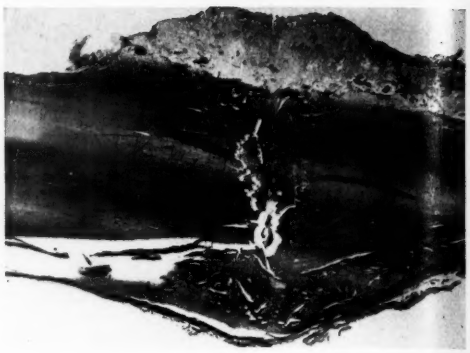
At 7 days following fracture, evidence of bone repair could be found only by histologic examination. Definite variation in the rate of fracture healing was seen in animals of the different groups. The castrated rabbit which received no estrogen (Fig. 2a) showed an abundance of osteoid tissue at the fracture site and presented the most advanced degree of bone repair at this stage.

At 14 days and 21 days following fracture, normal rabbits which received no estrogen revealed advanced stages of bone repair (Figs. 1a and 1b), manifested by almost complete union of the cortices, a small well-formed callus bridging the fracture site and advanced resorption of new bone trabeculae in the medullary canal. By contrast, the castrated rabbits which received estrogen (Figs. 3a and 3b) showed a marked delay in



a

b



c

FIG. 3. a, Group D animal at 14 days; b, at 21 days; c, at 35 days.

fracture healing. At 14 days these animals showed a large amount of embryonic cartilage progressing to more adult cartilage during the ensuing week. Roentgenograms at this stage showed little evidence of union (Fig. 4b) and this is in accordance with findings of Silberberg and Silberberg, that in castrated animals, callus formation is at first decreased and later increased. On the other hand in the animals which had been castrated but did not receive estrogen (Fig. 4a), there was roentgenologic evidence of almost complete union.

At 35 days, the control rabbit which received no estrogen showed complete union of the fracture (Figs. 1c and 4c). The castrated rabbit receiving estrogen again revealed the greatest delay in bone healing (Figs. 3c and 4d). Endosteal new bone formation completely obliterated the marrow cavity for a considerable distance on both sides of the fracture. This was in accordance with similar findings of Gardner and Pfeiffer and Urist, Budy, and McLean.

At 49 days, fractures in all 4 groups showed complete union (Figs. 2b, 4e, and 4f). However, the microscopic picture in the castrated rabbit which received estrogen revealed obliteration of the marrow cavity by endosteal bone formation on both sides of the fracture line.

The phosphatase curves of the fractures in all 4 groups of these experimental rabbits (Fig. 5) substantiated the findings in previous experimental work that the rapidity of healing of fractures is dependent not on the serum phosphatase concentration but on the amount of bone phosphatase produced locally at a fracture site. The concentration of bone phosphatase is, in turn, an indication of the amount of local osteoblastic activity and is concerned primarily with the calcification of newly formed osteoid tissue rather than with the formation of osteoid tissue.

The phosphatase curve of the control rabbits which received no estrogen showed the highest peak (at 14 days) and thereafter consistently maintained the highest phosphatase levels at least until very late in the process of fracture healing. This was interpreted as a normal bone phosphatase curve. If this is correct, then the remaining 3 groups of rabbits showed, by virtue of their decreased phosphatase levels, that there was decreased os-

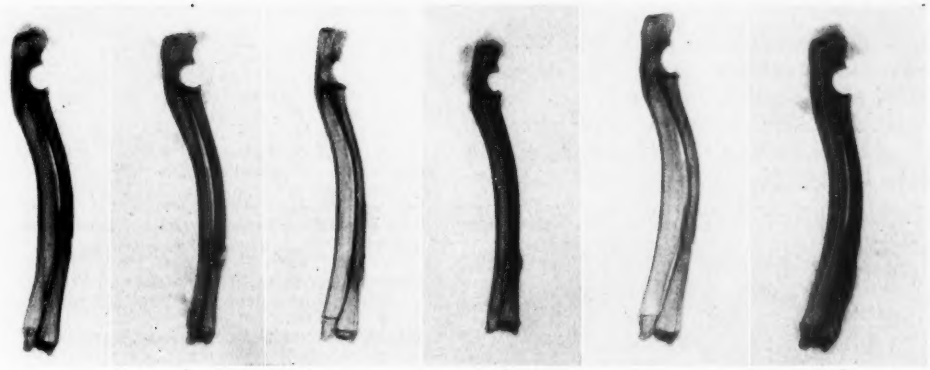


FIG. 4. Roentgenograms: a, group B at 14 days; b, group D at 14 days; c, group A at 35 days; d, group D at 35 days; e, group B at 49 days; f, group A at 49 days.

osteoblastic activity at the fracture sites. The lowered phosphatase curves in the 2 groups of rabbits which received stilbestrol indicated that estrogen decreased osteoblastic activity by interfering with the mechanism of the calcification of osteoid tissue, and not by interfering with the formation of osteoid tissue. The appearance of abundant osteoid tissue at the fracture site at 14 days in the control rabbit which received estrogen confirmed this. If estrogen had inhibited the formation of osteoid, the groups of animals showing delayed bone healing with estrogen would have shown normal bone phosphatase curves (indicating normal calcification of osteoid tissue). It is difficult to explain the lowered phosphatase curve in the group of castrated animals which received no stilbestrol, unless it is postulated that a certain amount of natural estrogen, for which stilbestrol cannot be substituted, is essential for normal bone healing.

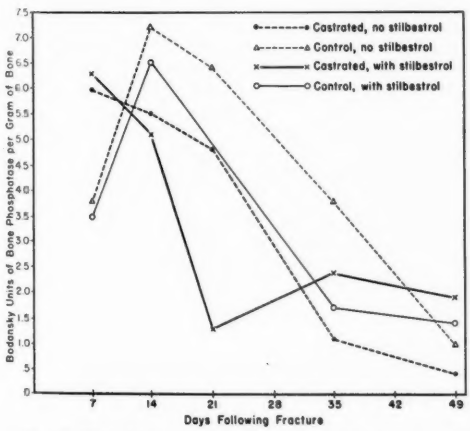


FIG. 5. Phosphatase levels obtained in the 4 groups of animals.

The persistent moderate elevation of bone phosphatase concentration at 49 days in both control and castrated rabbits which received estrogen tends to substantiate the thesis that prolonged estrogen administration delays fracture healing and is an indication that there persists a continued attempt at bone repair.

Since it has been determined that in mice estrogen decreased osteoblastic activity, it was theorized that the considerably higher bone phosphatase concentration in the 2 castrated animals at 7 days following fracture was due to the absence of the inhibiting property of estrogen on osteoblastic activity. Three milligrams of diethylstilbestrol in Persic oil in the castrated animal probably was too minimal an amount to produce any effect on osteoblastic activity within 7 days following fracture. It was further theorized, in like manner, that the low phosphatase concentrations of the 2 uncastrated rabbits at 7 days following fracture was due to the presence of natural estrogens.

CONCLUSIONS

1. Bone repair is delayed in both castrated and control rabbits by the administration of diethylstilbestrol in Persic oil.

2. This effect appeared to be more pronounced in castrated than in control rabbits. The former showed an excessive amount of poorly developed callus about the fracture sites.

3. The delay in bone repair appeared to be due to retardation in the calcification rather than in the formation of osteoid tissue.

4. Prolonged diethylstilbestrol administration increased endosteal bone formation at the fracture site and later inhibited the resorption of this endosteal bone.

REFERENCES

1. Botterell, E. H., and King, E. J. Phosphatase in fractures. Lancet, Lond., 1935, 1: 1267.
2. Gardner, W. U., and Pfeiffer, C. A. Skeletal changes in mice receiving estrogens. Proc. Soc. Exp. Biol., N. Y., 1938, 37: 678.
3. McKeown, R. M., Harvey, S. C., and Lumsden, R. W. Breaking strength of healing fractured fibulae of rats—VI, observations on the influence of bilateral ovariectomy. Arch. Surg., 1933, 26: 430.
4. Miller, E. W., Orr, J. W., and Rybus, M. C. The effect of oestrone on the mouse skeleton, with particular reference to the Newcastle bone tumor (NBT) strain. J. Path. Bact., Lond., 1943, 55: 137.
5. Silberberg, M., and Silberberg, R. Influence of the endocrine glands on growth and aging of the skeleton. Arch. Path., Chic., 1943, 36: 512.
6. Idem. Combined effects of an estrogen and an anterior hypophysial extract on the skeleton of the growing mouse. Arch. Path., Chic., 1945, 39: 381.
7. Urist, M. R., Budy, A. M., and McLean, F. C. Endosteal-bone formation in estrogen-treated mice. J. Bone Surg., 1950, 32-A: 143.

THE CLINICAL SIGNIFICANCE OF THE RIDGE OF PASSAVANT

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In 1863, PASSAVANT first described the anatomic structure now known as the ridge of Passavant. This appeared in his book entitled, *The Occlusion of The Pharynx During Speech*. The treatise was published in Frankfurt and represents one of the first studies of the physiology of speech.

Since that time, this fold has been almost completely ignored by laryngologists, while speech therapists and plastic surgeons dealing with cleft palate deformities have been little more cognizant of its importance. More recently, Hollinshead has fully described the ridge of Passavant and commented on its function.

It is the purpose of this paper to describe in detail this fold, to report certain laboratory and clinical observations regarding it, and to comment on its importance to the clinician.

MATERIALS AND METHODS

This article represents the observations from 32 dissections of the nasopharynx and oropharynx, some performed at the time of autopsy examination and some on cadavers. In addition, the anatomy of the area was studied during numerous surgical procedures on the nasopharynx and oropharynx.

Passavant first visualized the structure in a patient with a large cleft palate, which exposed the entire upper pharynx. The ridge of Passavant was first observed by me during a secondary adenoidectomy. The patient was an 8 year old male, who underwent anesthesia with considerable difficulty. As a result, when the palate was elevated with the Love retractor, the patient reflexly gagged and this linear band could easily be seen. It was my impression at first that this was a mere cicatrix which had resulted from the previous adenoidectomy and was therefore an artefact, not a natural anatomic structure. However, subsequently this ridge has been seen many times during adenoidectomy and in patients with palate defects, both acquired and congenital. It has been my experience that those children in whom the ridge of Passavant was interrupted with the adenotome during adenoidectomy experienced postoperatively a more prolonged period of nasality in their speech. This observation led to a further study of the importance of the entity.

The ridge of Passavant is a transverse fold (Fig. 1) of the posterior pharyngeal wall, which develops during speech, swallowing, retching, vomiting, or whenever it is necessary to shut off the nose from the mouth. It is linear, pencil-sized in the adult, and located a few millimeters below the base of the uvula. It extends across the entire breadth of the posterior pharyngeal wall, including the raphe. Upon phonation it is elevated to the level of the atlas.

Many investigators have argued over the nature of this ridge. It appears to be a simple mucous membrane fold, but containing not enough muscle in the muscularis mucosae to form it alone. Stein suggested that it was formed by the puckering of the mucosa due to the superior constrictor. The upper and inner horizontally disposed fibers were thought to form a nasopharyngeal or palatopharyngeal sphincter.

Another concept, which is actually the one that Passavant held, is that the fold is produced passively by an elevation of the pharynx by the palatopharyngeus muscle with the salpingopharyngeus assisting (Fig.

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FIG. 1. Illustration showing the ridge of Passavant on the posterior pharyngeal wall formed when the palate was elevated with the Love retractor and the patient reflexly gagged.

2). This would seem unlikely, because these bilateral muscles would cause a dimpling at the median raphe, but there is none in the ridge of Passavant.

One of the difficulties in studying this structure was that it is only seen in the moving pharynx, such as during gagging. Thus postmortem examinations are not particularly conclusive. It has been stated that this fold may be absent, but it has been my experience during surgery that it may be demonstrated in almost everyone, under the proper conditions.

As a result of these studies, it is my opinion that the muscle responsible for this fold is almost exclusively the superior constrictor of the pharynx. The function of the pharyngopalatine muscle is important in closing the nasopharyngeal sphincter laterally, but its role in the formation of the ridge of Passavant is doubtful. The same is true of the salpingopharyngeus muscle.

A dissection of the superior constrictor shows that this muscle at its upper border is slung somewhat like a hammock from the medial pterygoid plate and its hamulus across to the median raphe. The interval between the upper border of the muscle and the base of the skull is closed by the pharyngeal aponeurosis, known as the sinus of Morgagni. When the superior constrictor contracts, it is pulled up from its sagging position to a straight line obliterating much of the sinus of Morgagni. This upward pull of the muscle tends to carry the overlying mucous membrane with it, buckling it against the base of the skull. Because the mucosa is not directly attached to the muscle, the formation of this ridge is highly variable. It is less likely to form where there is much soft tissue between mucosa and muscle, such as where there is an adenoid mass.

THE SPHINCTER OF THE NASOPHARYNX

During deglutition, retching, vomiting, and articulation of vowels, the nasopharynx must be separated from the oropharynx. The closure of this aperture is accomplished by the apposition of the uvula and soft palate with the ridge of Passavant in the posterior pharyngeal wall. The soft palate is pulled upward and backward almost in contact with posterior pharyngeal wall by the levator veli palatini. The fold at the same time buckles forward to close the space.

As Browne points out, the mechanism for closing the nasopharynx is the same as in so many other passages of the body, i.e. the device of a complete muscular ring or sphincter. This ring is set in a plane running posteriorly and slightly upward from the middle of the soft palate to the posterior pharyngeal wall immediately below the adenoid area. It would appear that this was not a simple circlet like the sphincters of the bowel, but that this closure is effected by two sliding doors (the soft palate and the ridge of Passavant), which come together and shut off the nose from the mouth. The posterior shelf (ridge of Passavant) appears with the contraction of the fibers of the superior con-

strictor and possibly the palatopharyngeus muscles laterally. The anterior shelf (soft palate and uvula) is moved by the two levators and the two tensor muscles of the palate, the latter being supplied by the otic ganglion.

The fold may be seen during speech, especially during the formation of nasal sounds, although it appears and disappears rapidly with the movement of the rest of the sphincter (the soft palate). When the patient says, "ah," one may see the middle of the palate go back into a sort of a dimple with the contraction of the levators, while the posterior edge does not touch the back of the pharynx. On the contrary, the uvula, acting in concert with the other muscles of the same innervation curls the posterior edge of the palate forward. Thus, it is not necessary for the proper action of the soft palate that it should be long enough for its edge to reach the posterior wall of the pharynx. It need only reach to the fold of Passavant. This idea is in contrast to most teaching of reconstructive surgery in the anatomic area.

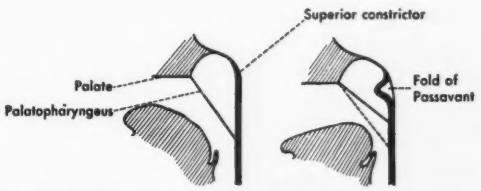

FIG. 2. Diagram illustrating the formation of the ridge of Passavant and showing the relationship of the palatopharyngeus and the superior constrictor muscles to the fold. From Hollinshead.

SURGICAL ANATOMY

With this anatomic concept in mind, many ideas that were held in the past are contradicted, and our teaching of surgical anatomy must be altered. For example, it has generally been thought that nasality after adenotonsillectomy and the escape of liquids out through the nose upon swallowing after such surgery was caused by damage to the pillars (glossopalatine and palatopharyngeus muscles). Whereas, it is more likely to occur because of the complete removal of the ridge of Passavant with the adenotome. Of course, the posterior pillar (palatopharyngeus) does enter into the nasopharyngeal sphincter, and damage to it would undoubtedly partly prevent the elevating of the pharynx and the closure of the aperture. However, there are examples wherein the entire posterior pillar had been inadvertently removed, yet there was no inability to close the nasopharynx. This was due to the fact that the ridge of Passavant had been left intact and the superior constrictor was able to form it. Also, 4 children were seen who had a strongly nasal speech and who lost liquids through the nose for a brief period postoperatively. Yet they had intact pillars anteriorly and posteriorly bilaterally. But because the ridge of Passavant had beentraumatized during the removal of the adenoids and lymphoid tissue on the posterior wall, it was not possible for them to close off the nasopharynx.

From this discussion too, it is seen that it is not necessary for the proper action of the soft palate that it should be long enough for its edge to reach the posterior wall of the pharynx, as is so often stated. Perfect control of the nasopharyngeal opening, and consequently perfect speech, is possessed by many in whom, owing to congenital defects or to surgical attacks on the tonsils and uvula, the palate is so short that its edge can never meet the back wall. The ridge of Passavant closes this hiatus, contrary to the opinion of Calnan.

In repairing cleft palates, the conception of a sphincter as the final result of the operation eliminates the flap operations of the Davies-Colley and Lane variety. It also explains the notorious failure to give normal speech by means of the thin layers of epithelium and scar tissue which they produce. Similarly the recollection of the proper function of the anterior shutter should prevent a thin, atrophic soft palate containing hardly any muscle from being called, as it so often is, "a perfect anatomic result" of operation.

CONCLUSIONS

1. The ridge of Passavant is an important physiologic component of the nasopharyngeal sphincter.

2. This structure is formed in the mucosa of the posterior pharyngeal wall as a result of the active constriction of the upper and inner horizontally disposed fibers of the superior constrictor muscle.

3. The nasopharyngeal sphincter is formed by the levators pulling the palate upward and back, by the palatopharyngeus pulling lateral pharyngeal walls inward, and by the ridge of Passavant bulging anteriorly from the posterior pharyngeal wall.

4. Because of its importance in articulation and deglutition, this area should be subjected to a minimum of trauma if postoperative speech and swallowing difficulties are to be avoided.

REFERENCES

1. Browne, D. The operation for cleft palate. Brit. J. Surg., 1932, 20: 7.
2. Calnan, J. The error of Gustav Passavant. Plastic & Reconstr. Surg., 1954, 13: 275–289.
3. Hollinshead, W. H. Anatomy for Surgeons. Vol. 1—The Head and Neck. Pp. 416–417. New York: Paul B. Hoeber, Inc., Med. Book Dept. of Harper & Bros., 1954.
4. Passavant, R. The Occlusion of the Pharynx During Speech. Frankfurt am. Main, 1863.
5. Stein, L. Zur Frage des Passavant'schen Wulstes. Wien. med. Wschr., 1930, 35: 1152–1153.

SPONTANEOUS FISTULAS BETWEEN THE GALLBLADDER AND GASTROINTESTINAL TRACT

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WHILE ARTIFICIALLY MADE ANASTOMOSES between the gallbladder and upper gastrointestinal tract may exist for a long time without giving rise to clinical symptoms, it has been shown experimentally by Beaver, that liver damage of some degree invariably results from them. Spontaneous fistulas between the gallbladder and adjacent viscera expose the patient to the same liver complications and are frequently associated with other pathologic conditions that require surgical intervention. Preoperative diagnosis of these fistulas is often overlooked, in spite of a thorough clinical and roentgenographic investigation, and the condition is then discovered unexpectedly at operation. Their surgical management presents a problem because they occur usually in elderly individuals, often obese, occasionally jaundiced, and sometimes toxic because of an intestinal obstruction. In the hope of throwing some light on the problems involved, the cases in two local hospitals with average combined populations totaling 400 were reviewed. Thirteen patients were found in the last 10 years, 10 in which the fistulas were between the gallbladder and the duodenum, 2 between the gallbladder and the stomach, and 1 between the gallbladder and colon. All 13 patients were operated upon without any surgical or hospital deaths. Two died subsequently from carcinoma. One has been lost to follow-up. The remainder are alive but 1 of them is still ill with cirrhosis.

Determination of the cause of the fistulas is of paramount importance as it influences the choice of operation. The overwhelming proportion of fistulas are due to gallstone perforation. All 13 of our cases were believed to be due to this cause. Only in some of these patients does gallstone ileus occur. Six of our series had operations for gallstone ileus. In 2 of these long periods had elapsed, 16 years in Case 1, and 7 years in Case 2, before complications of the persistent fistula developed which required further surgery. Small gallstones may erode their way into the duodenum and produce only mild symptoms of a partial obstruction for a few days and then be passed, as in our Case 3. Fistulas of this origin may exist for a long period after formation and, if not complicated by a common duct stone, may close spontaneously, either completely or to such a degree that they cannot be demonstrated by roentgenography at a later date. Whether it is necessary to have an associated obstruction of the common duct to maintain the patency of these fistulas is not known. As a rule abnormal fistulas of other organs tend to close if the normal pathways are still open. In our Case 2, the fistula remained patent for 7 years in spite of an unobstructed common duct. However, the presence of jaundice in a case of cholecystoduodenal fistula should make one suspicious of a common duct stone or tumor.

A malignant condition in the gallbladder, in which stones may be an etiologic factor, was found in 1 of our cases of cholecystoduodenal fistula. In a second case (Case 1), 16 years after operation for gallstone ileus the patient died from cancer of the liver, presumably secondary to cancer of the gallbladder. A carcinoma of the gallbladder it-

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self may extend to and perforate the duodenum. Such, however, is not commonly the case. In the description of two series of cases of carcinoma of the gallbladder comprising a total of 145 cases, perforation into the duodenum was only mentioned once. In our cases of carcinoma of the gallbladder associated with fistula into the duodenum, the fistula formed at least 7 years earlier in one, and 16 years earlier in the second at which time large gallstones were removed to relieve ileus.

A duodenal ulcer can penetrate, adhere to, and perforate the gallbladder. Two such cases were reported by Clark. Duodenal ulcers, however, perforate into the common duct much more frequently than into the gallbladder. It may be difficult at times to be certain as to the exact cause of the fistula, as in our Case 13.

In the 10 cases of spontaneous internal biliary fistulas reported by Garland and Brown in 1942, 8 involved the gallbladder and 2 the common duct. Seven of the 8 were between the gallbladder and the duodenum. Four of these 7 were due to carcinoma. In 2, the carcinoma arose in the gallbladder, and in 2, it arose primarily in the pancreas. One of their cases was due to a large stone, 1 was secondary to an empyema of the gallbladder, and 1 to a right upper quadrant abscess following appendectomy. Since primary carcinoma of the gallbladder is thought to be associated with stones in practically all cases, it is reasonable to assume that malignant lesions reported in this series had been associated with calculi.

It has been estimated by Benjamin that in 4 per cent of gallbladders containing stones and not operated upon, carcinoma of the gallbladder will ultimately develop.

CLINICAL STUDY

Symptoms. The clinical picture of these fistulas varies greatly, depending upon the stage in which they are encountered. In those associated with acute gallstone ileus, the symptoms of intestinal obstruction may mask those of the fistulas. Rarely do violent symptoms occur during the formation of the fistula when the gallstone passes from the gallbladder into the duodenum. Such pain as is experienced is usually indistinguishable from that which follows due to the intestinal obstruction. Bleeding into the gastrointestinal tract with hematemesis and melena occurred in 2 of our cases. In 9 of our cases, a history suggesting cholecystitis was noted. Pruritis from jaundice was present only in a few. Weight loss was a prominent feature of 3 cases, that of carcinoma of the gallbladder (Case 2), cirrhosis (Case 3), and jaundice with common duct stone (Case 4). Chills and fever occurred in 4 cases. Contrary to what one would expect, these were absent in the case of the cholecystocolic fistula, probably due to the fact that a large stone in the cystic duct prevented regurgitation of the content of the colon into the higher biliary tree. In reviewing our series, we were impressed by the fact that a number of these patients were asymptomatic and apparently enjoyed good health for long periods after fistula formation.

Physical examination. Obesity was a common finding in our series, except when modified by weight loss as described before. Most patients were elderly, varying from 46 years to 80 years, the average being 62 years. Jaundice was present in 3. In 1 it was due to a common duct stone. Worthy of reemphasis is Puestow's observation that in 7 out of 9 of his series of fistulas associated with jaundice a common duct stone was found. Our second case of jaundice was associated with cirrhosis. Both liver and spleen were enlarged and liver biopsy confirmed the diagnosis. In the third case, the jaundice apparently was of inflammatory origin and disappeared after cholecystectomy and drainage of an adjacent abscess. The common duct was not explored.

The findings on abdominal examination were variable, and ranged from minimal or negative signs to those presenting right upper quadrant tenderness, rigidity, or a palpable mass. Distention, increased peristaltic sounds, and visible waves were pres-

ent in the cases complicated by acute gallstone ileus. In Cases 7 and 8, the marked tenderness in the right lower quadrant over impacted stones in the terminal ileum was so impressive that an erroneous diagnosis of appendiceal abscess was made in the first and acute appendicitis in the second.

Roentgenographic examination. Fistulas between the gallbladder and the gastrointestinal tract may be easily overlooked in the course of an x-ray examination. Failure to elicit positive x-ray findings may result even though the fistula is suspected. Reflux of barium from the duodenum into the gallbladder is, of course, confirmation of a suspected fistula. In Case 4, regurgitation of barium was apparent even out into the peripheral biliary radicles (Fig. 2).

Air in the biliary tree is an important finding and was reported in 5 of our cases. In Case 7, air in the biliary tree detected in the flat abdominal film was the basis of an x-ray diagnosis of intestinal obstruction due to a gallstone, with a cholecystoduodenal fistula (Fig. 4).

Visualization of the gallbladder with the dye failed in 4, but was successful in 3. However, in 1 of these (Case 9), the film was taken 6 months before operation, probably prior to the formation of the fistula. In Case 12, x-ray films showed a faintly outlined gallbladder with shadows suggestive of stones. At operation no stones were found. In Case 13, a faintly outlined gallbladder without evidence of stones was reported. Multiple stones were present at operation.

In no case were opaque stones seen in the plain flat film.

Laboratory findings. Blood counts were unimpressive. When changes did occur, they were attributable to complicating factors rather than the fistulas themselves. A severe secondary anemia was present in the cirrhosis case. In the cases of jaundice the icteric index was elevated to 29.2 units when the etiology was due to common duct stone, and as high as 70 units in the case with associated cirrhosis. In this latter case a reversal of the albumin globulin ratio, increased thymol turbidity, and cephalin flocculation tests were further indications of liver damage, but gave no specific information relative to the fistula itself. These latter studies were incomplete in the remaining cases.

CASE REPORTS

Our 13 cases, to be described, are grouped according to their outstanding feature, although some had features of other groups as well.

Malignancy as a Late Complication

CASE 1. Mrs. S. G., aged 50 years, was first admitted on November 1937, complaining of nausea, vomiting, and abdominal cramps for 6 days. Her past history was negative. A laparotomy for a bowel obstruction was performed and a 3 by 3 centimeter gallstone in the lower ileum was removed. She was next admitted in November 1953 complaining of acute upper abdominal pain, with vomiting. She had been well except for a milder attack for 4 days 4 years earlier. Examination revealed obesity and epigastric and right hypochondrium tenderness. She had chills and fever, a white blood count of 8,850, 69 per cent polys. The gallbladder failed to visualize with the dye but air was noted in the main hepatic ducts. Upper gastrointestinal series revealed a small amount of barium passing up through the gallbladder into the ducts and out into the smaller biliary radicles, and a large area of increased density below the right diaphragm. A large subdiaphragmatic abscess was found and drained. A cholecystoduodenal fistula was noted. Biopsy of liver reported metastatic carcinoma. Immediate postoperative recovery was uneventful. She expired May 1, 1954 from carcinoma.

CASE 2. Mr. F. A., aged 71 years, obese, was first hospitalized in 1947 with acute abdominal pain, distention, and vomiting. Laparotomy was performed and a large gallstone obstructing the ileum was removed. He was well until April 1954 when he complained of weight loss and weakness. Examination revealed a 5 centimeter mass in the right subcostal region. X-ray studies reported a fistula between the gallbladder and duodenum. Air was visualized in the biliary radicles, and stones in the gallbladder were suspected. A preoperative diagnosis of cholecystoduodenal fistula, gallstones, and possible malignancy was made. At operation a large abscess was found, which was subhepatic and intrahepatic and communicated with a fistula between the gallbladder and duodenum. Shadows within the gallbladder noted on x-ray examination were found to be papillary projections of a carcinoma of the gallbladder. There was malignant invasion of the adjacent liver. A subtotal gastric reaction was performed. Closure of the duodenum was

FIG. 1. Case 3. Showing reflux of barium from duodenum into gallbladder.

precarious and a catheter drain was sutured into the closed stump and brought out through a stab wound. The abscess and gallbladder were drained separately. Suction on the duodenal catheter was instituted. Upon its withdrawal 1 week later, the duodenal fistula closed spontaneously. His gastrointestinal reconstruction functioned successfully. The patient died 5 months later of malignancy.

Cirrhosis Developing in a Patient with Cholecystoduodenal Fistula

CASE 3. Mrs. D. B., aged 67 years, entered on May 17, 1954. Her present illness began 5 months earlier with an attack described as flu, following which jaundice developed. When admitted, she complained of severe itching, anorexia, and a weight loss of 20 pounds. About 7 months earlier, she had moderate acute upper abdominal pain followed by cramping and distention for 1 week. Her highest temperature was 99.2 degrees F. The patient was deeply jaundiced, and she showed marked evidence of weight loss. The liver was enlarged to 3 fingerbreadths below the costal margin. The spleen was firm, and palpable 3 fingerbreadths below the costal margin. The first gastrointestinal roentgenograms were reported negative. A later review revealed these as showing barium overlying the gallbladder region, and gas in the biliary tree indicating an internal biliary fistula (Fig. 1). Roentgenograms with the dye failed to visualize the gallbladder. Laboratory examination showed: red blood count of 3,500,000, no spherocytes, hemoglobin 69 per cent, white blood count of 3,150, 68 per cent polys; Coombs test negative; total proteins 7.7, globulin 4.7 grams, albumin 3.0 grams; serum alkaline phosphatase 41.1 King-Armstrong units; thymol turbidity 16.9 units; cephalin flocculations, 4+; prothrombin 13 seconds; icteric index 56 units; urine—trace of albumin, rare hyaline cast, and urobilinogen present in 1 to 10; clotting bleeding times and fragility test normal. After 3 weeks of conservative treatment without improvement, operation was advised.

An oblique subcostal incision was made. The liver was enlarged, had a granular surface and rounded edge; the spleen was enlarged but smooth. There was no evidence of carcinoma. Dense adhesions were found between the duodenum and gallbladder. Because of evidence of extensive liver damage, it was thought advisable to be conservative. An opening was made in the prepyloric area, and a finger introduced into the duodenum and through the stoma of the fistula. Palpation revealed a smooth gallbladder wall without stones or tumor. On withdrawing the finger, a large gush of greenish bile was observed. The common duct was not explored. It was concluded that the jaundice was probably on the basis of cirrhosis, which may or may not have been due to the fistula. The opening in stomach wall was then closed and nothing further done. The patient recovered rapidly, but the jaundice has persisted, her recent icteric index being 45 units. At no time has she had pain. A refractory anemia has followed, and to date she has had 40 transfusions. Her appetite has improved and the itching has disappeared. The spleen and liver are slightly smaller. A liver biopsy was interpreted as an early cirrhosis.

The patient's fistula probably developed about 7 months prior to the onset of jaundice. Had there not been such extensive liver damage, and had her general condition permitted a more extensive procedure, it would probably have been preferable to remove the gallbladder, explore the common duct, and close the fistulous tract. A second operation has been proposed. The possibility of a common duct stone must be considered.

Jaundice in Cases of Cholecystoduodenal Fistulas

In addition to the 2 cases described below, marked jaundice was present in the patient with cirrhosis (Case 3).

CASE 4. Mrs. G. G., aged 52 years, was admitted on January 24, 1951. For 3 weeks she had had intermit-

tent ramps in the right upper abdomen, with nausea, vomiting, flatulence, chills and fever, and jaundice. A gradual weight loss of 50 pounds had occurred in the past months in spite of a fair appetite. Four years earlier, she had been hospitalized with a gallbladder attack during which 3 gallstones were passed in the stool. Tarry stools were then present. At that time she had chills, pain, and vomiting. Roentgenograms then showed a nonfunctioning gallbladder. She improved and operation was deferred because of obesity and hypertension. Since, she has had occasional moderate attacks of upper abdominal distress, flatulence, and indigestion. Examination revealed an obese patient with a blood pressure of 198/90 and temperature of 99 degrees F. There was only slight abdominal tenderness. Icteric index was 29. Cholecystography on January 25, 1951 revealed nonvisualization of the gallbladder and no calculi. X-ray examination of the upper gastrointestinal tract showed a deformed irritable duodenal bulb, and barium passed through a contracted gallbladder into the hepatic ducts. The regurgitation of barium was striking, extending into the peripheral portions of the biliary tree in the right lobe (Fig. 2). Laboratory examination showed: a white blood count of 7,500, 68 per cent polys, total proteins and the albumin globulin ratio normal and prothrombin time 83 per cent.

Operation was performed on January 30, 1951. The preoperative diagnosis was subsiding acute cholecystitis, cholelithiasis, and cholecystoduodenal fistula. A right rectus incision revealed a hard adherent mass, in the region of the gallbladder. On opening the gallbladder, a fistula 2 centimeters in diameter into the duodenum, was exposed. The necrotic walled gallbladder containing about 50 stones was removed. Bile was noted entering the duodenum via the ampulla of Vater, hence the common duct was not opened. The duodenal defect was sutured transversely. The operative site was drained. Convalescence was uneventful and jaundice cleared. However, jaundice recurred 3 weeks later, and the patient required a second operation on May 21, 1951. At this time the common duct was explored and a stone 2 centimeters in diameter was removed from its lower end. The patient made a rapid recovery.

This case illustrates the importance of the exploration of the common duct in cases of fistulas with jaundice. This was stressed by Puestow. Melena, present in her first attack, was a conspicuous feature, and was probably due to erosion of a stone through the duodenal wall. This case vividly illustrates the inability of the valves of Heister to prevent regurgitation into the upper biliary tree.

CASE 5. Mr. F. H., aged 54 years, entered on November 23, 1954, complaining of mild right upper quadrant pain for 9 days. The pain became more severe, and distention and jaundice developed. He had been hospitalized 2 years previously with a similar attack, which subsided spontaneously. Examination showed the patient to be moderately obese and jaundiced. There was only slight tenderness in the right upper quadrant; no rigidity nor masses were palpable. Fever ranged from 100.6 to 101 degrees. Laboratory examination revealed a white blood count of 10,500, 78 per cent polys; icteric index 44 units. A flat film revealed no opaque calculi, no air in the biliary tree, but some gas scattered through the bowel. A cholecystogram taken on previous admission showed a faintly outlined gallbladder and a shadow suggesting a stone.

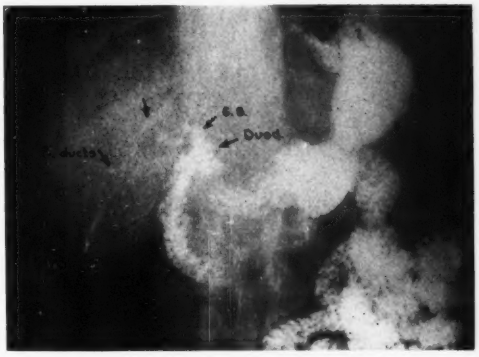

FIG. 2. Case 4. Regurgitation of barium through gallbladder into peripheral biliary radicles.

Operation was performed on November 27, 1954 with a preoperative diagnosis of common duct stone. There was found omentum walling off a ruptured gangrenous gallbladder with numerous stones in abscess cavity. The gallbladder was removed. Attempt to explore the common duct was abandoned because of severe bleeding. A fistula, 2 centimeters in diameter into duodenum, was discovered. Closure of the fistula was unsatisfactory and omentum was used to reinforce the transverse suture line. Drains were placed down to fistulous site and brought out through a stab wound. On the second postoperative day, large amounts of bile drained. Hiccough was troublesome. Fever (102 degrees F.) continued for the first 5 days. Drainage of bile ceased on the ninth day, the jaundice cleared, and subsequent recovery was rapid. There has been no return of symptoms or jaundice.

Jaundice in this case was probably of inflammatory origin.

Gallstone Ileus Associated with Cholecystoduodenal Fistula

Acute intestinal obstruction was present in 4 cases. Two other patients (Cases 1 and

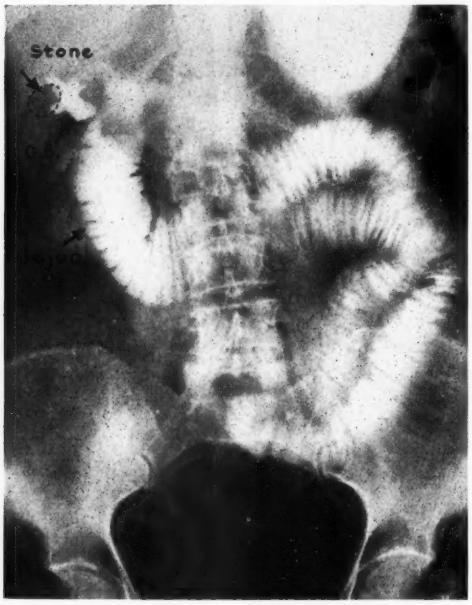

FIG. 3. Case 6. Barium retained in gallbladder outlining a residual stone. Dilated loops of small bowel due to gallstone ileus.

2) in whom malignancy eventually developed, also had been operated upon for this complication.

CASE 6. Mrs. S. R., aged 67 years, entered the hospital on April 13, 1953. For 4 years she had been troubled with flatulence and epigastric distress after fats, and occasional vomiting. Ten days previous to admission, she had had chilly sensations but no fever. Six days before entry, an epigastric fullness and distress developed, without appreciable pain. Persistent vomiting commenced, the vomitus containing food, bile, occasionally several ounces of bright blood and once a large amount of coffee-ground material. The patient was obese and dehydrated. Her temperature was 99 degrees F., pulse 84. Her abdomen was moderately distended. There were no palpable masses, localized tenderness, nor rigidity. Gastric suction was instituted. Later an upper gastrointestinal study with barium was made. This revealed a cholecystoduodenal fistula. Distended small bowel loops were interpreted as evidence of intestinal obstruction (Fig. 3). Her white blood count was 15,000, 83 per cent polys.

At operation dense adhesions in the right upper quadrant were freed, exposing a small thick-walled gallbladder. The gallbladder was opened and a large stone removed. A fistula, 1 centimeter in diameter into the duodenum, was disclosed. The gallbladder was removed. The edges of the fistula were excised and the duodenum closed transversely. The small bowel was then explored and a larger gallstone was found in the lower jejunum, obstructing it completely. The stone was removed. An anterior gastroenterostomy was performed. Drains were placed down to the gallbladder site and brought out through a stab wound. The postoperative course was uneventful, and the patient left the hospital on the twenty-first day. Since she has been in good health.

In retrospect we believe that the gastroenterostomy was unnecessary and increased the operative risk. Hematemesis in this case was a prominent symptom and led to the consideration of a possible ruptured duodenal ulcer with a paraduodenal abscess.

CASE 7. Mrs. N. H., aged 69 years, entered the hospital on August 31, 1953, complaining of nausea, vomiting, and severe lower abdominal cramps of sudden onset 4 days previously. These persisted and the vomitus became fecal. She had had slight cramps for 3 days, 18 days previously. Two months prior, she had been in the hospital for 6 days with acute abdominal pains, vomiting, and loose dark stools. At that time, her temperature had been 101 degrees, and her white blood count 19,250, 88 per cent polys. She was dismissed improved with a diagnosis of acute cholecystitis. Examination revealed an obese, elderly, acutely ill patient, with a pulse of 128. Her highest temperature was 100 degrees F. rectally. Her abdomen was moderately distended. There was marked tenderness and slight rigidity of the right abdomen, more prominent below the umbilicus, with a suggestive mass in the right lower quadrant. A flat film revealed gas scattered irregularly throughout the gastrointestinal tract, and also air in the biliary ducts (Fig. 4). A barium enema showed a contracted caput of the cecum. Her white blood count was 16,650, 79 per cent polys; nonprotein nitrogen 56 milligrams; icteric index 10.4 units; total proteins 6.4, with 4.1 albumin and 2.3 globulin (A/G = 1.7:1).

The preoperative diagnosis was intestinal obstruction, due either to (1) an appendiceal abscess, or (2) to a gallstone with the cholecystoduodenal fistula, or (3) to a carcinoma of the cecum. At operation on September 4, 1953 a transverse incision in the right lower quadrant was made. The terminal ileum was collapsed, but 2 feet above the ileocecal valve, a large gallstone causing complete obstruction was found and removed. No other stones could be palpated. Because the patient was so acutely ill, no further procedures were attempted. Convalescence was uneventful and the patient was dismissed on the eleventh postoperative day. Thirteen months later she was requested to return for study. Since her operation she had been asymptomatic and in good health. The present study

showed a normal upper gastrointestinal tract, with a normal appearing bulb. There is now no evidence of air in the biliary tract. The dye reveals no visualization of the gallbladder. No calculi were visualized.

This case illustrates the importance of looking for, and properly evaluating the significance of air found in the biliary tree. Preoperative x-ray diagnosis of a cholecystoduodenal fistula was made on this basis in the flat film taken to determine the presence of an intestinal obstruction. It also shows that these fistulas may close either completely or to such an extent that it is difficult to demonstrate them at a later date. This follow-up study shows a nonfunctioning gallbladder. The patient is asymptomatic. Because of her age and obesity, it was thought inadvisable to do any further surgery unless complications arise.

CASE 8. Mrs. H. L., aged 71 years, was admitted April 12, 1954, complaining of epigastric pain, which later localized in the right lower quadrant. She had had attacks of nausea, vomiting, and epigastric pain off and on for 1 year. No chills nor fever were present. She had had anginal pains on effort for several years. The patient was thin. There was rebound tenderness in the right lower quadrant. Her blood was 145/80, temperature 99 degrees, white blood count 16,250, 90 per cent polys. No preoperative x-ray films were taken.

At operation on the day of entry with a preoperative diagnosis of acute appendicitis, a McBurney incision was made. On opening the abdomen, a large amount of thin greenish fluid escaped. A right upper rectus incision then was made and exploration revealed a large stone in lower ileum and a cholecystogastric fistula. The stone was removed and bowel closed, but because of patient's age and cardiac status, further attack on the fistula was thought inadvisable. Drains were placed to the vicinity of the fistula and brought out through a stab wound. Irregular fever and loose stools were present for a few days. The patient left the hospital on the fifteenth day in good condition. No further nausea nor epigastric pain have occurred. Her health has been good. In November 1954, an upper gastrointestinal series showed no evidence of fistula. The gallbladder fails to visualize with the dye. No residual stones were detected.

CASE 9. Mrs. M. G., aged 84 years, entered July 7, 1949, complaining of generalized abdominal pain, vomiting, and constipation for 1 week. She had had severe right upper quadrant pain, nausea, and vomiting several times a month for 2 years. A cholecystogram 6 months earlier showed a faintly outlined gallbladder with a large negative shadow. A gastrointestinal series then was negative. Examination showed an obese patient with moderate abdominal distention and moderate tenderness in the right lower quadrant. No masses were palpable. White blood count was 10,500, 82 per cent polys. Distention increased and a flat plate suggested a large bowel obstruction at the splenic flexure.

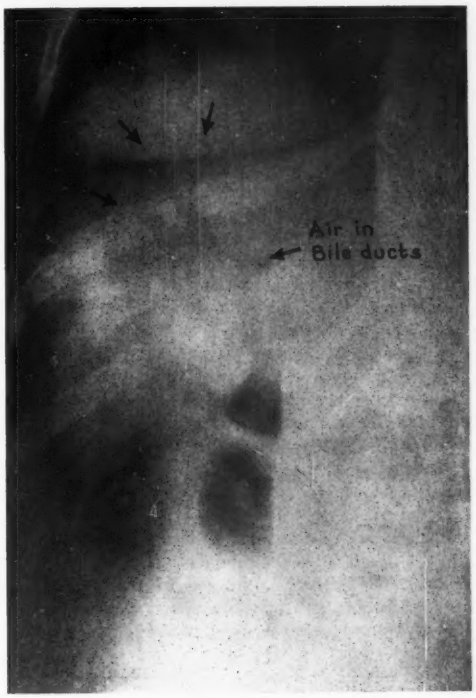

FIG. 4. Case 7. Air noted outlining biliary tree in flat plate of abdomen.

On July 8, 1949, a cecostomy was performed without relief. A barium enema on July 12, ruled out a large bowel lesion. The small bowel had been well decompressed by a Miller-Abbott tube. Barium injected into the tube on July 18 showed an ovoid filling defect in the distal ileum, interpreted as a large gallstone. On July 19, laparotomy was performed and a large gallstone removed from the terminal ileum. Convalescence was rapid and the patient discharged thirteenth postoperative day. Subsequently she had been asymptomatic. In November 1954 she was requested to return for study. The gallbladder failed to visualize with the dye and no stones were seen. On upper gastrointestinal study, a persistent deformity of the duodenum was interpreted as herniation of the gastric mucosa. No barium passed into the biliary system, nor was any air present.

Cases Diagnosed Preoperatively as Gallbladder Disease

CASE 10. Mrs. B. C., aged 61 years, admitted February 1, 1945, complaining of severe pain, radiating to her back for 24 hours, and vomiting. She had had a similar attack 9 years previously, lasting 3 days, since had been well. Examination revealed obesity and moderate tenderness in the right upper quadrant, no palpable masses, and no jaundice. Temperature was 99 degrees F., white blood count 14,050, 66 per cent polys. X-ray films made with the dye showed no visualization of the gallbladder and no demonstrable calculi; however, air was seen in the biliary tree.

At operation on February 2, 1945, with a preoperative diagnosis of cholecystitis with stones, an enlarged liver with a granular, reddish-blue surface with a rounded edge was found. The gallbladder was adherent to the distal stomach. A stone, the size of a walnut, could be palpated through the stomach wall. The gallbladder was found to be contracted to a narrow band of scar tissue and the attempt to remove it was abandoned. A gastrotomy was performed, the stone was removed, and the fistula explored. The fistula communicated with the stomach just proximal to the pylorus. The opening in the stomach wall was closed, and the fistula was left. Recovery was uneventful. She was asymptomatic for 3 years, then lost to follow-up.

Practically complete obliteration of the gallbladder associated with fistula was reported by Bennett and Hewko in their case. Evidence of liver damage from the fistula was apparent in this case. Air in the biliary tree was seen in the preoperative x-ray films, and had sufficient significance been attributed to this a fistula might have been diagnosed preoperatively. This was one of our earlier cases. Being more cognizant of the hazards of liver damage and carcinoma, we now would remove the gallbladder and close the fistula.

CASE 11. Mr. L. G., aged 63 years, was first seen August 2, 1951. For 1 week he had noted a slightly painful lump in his right upper abdomen. His appetite had been good but he had had slight belching for 1 week. There were no chills or fever. He had lost 5 pounds. Examination revealed a large, slightly obese individual without fever, or jaundice. There was a large ovoid, slightly tender mass in the right upper quadrant. X-ray examination with dye showed no concentration in the region of the gallbladder, and no calculi. An upper gastrointestinal series was negative. White blood count was 9,600, 72 per cent polys.

On August 6, 1951, the preoperative diagnosis was hydrops of the gallbladder with cystic duct stone. The adjacent viscera were densely adherent to the fundus of an enlarged gallbladder. The gallbladder was opened. Its walls were more than a centimeter thick. A frozen section revealed no malignancy. The gallbladder and cystic duct contained a number of stones. These were removed, revealing a fistula into the transverse colon. The gallbladder was then dissected free and removed except for a small portion of its wall adjacent to the liver. A drain was placed into the stump of the cystic duct. The edges of the stoma were excised and the colon closed. Convalescence was uneventful. When last seen in October 1954, he had had no further symptoms.

Others have found that fistulas between the gallbladder and colon were associated with more severe ascending infection than those involving the duodenum or stomach. One would expect this to be the case, yet our patient looked remarkably well, was afebrile, and had very mild symptoms. This may have been due to cystic duct obstruction by stones, which prevented regurgitation to higher levels.

CASE 12. Mrs. R. C., aged 50 years, was admitted April 6, 1953, complaining of vomiting of bile stained material. For 10 years following an attack of typhoid, she has had intermittent attacks of vomiting, epigastric distress, and mild right upper quadrant pain, aggravated by fats. Examination revealed an obese patient with normal pulse and temperature. There was some tenderness but no rigidity, nor mass in the right upper quadrant and no jaundice. A gastrointestinal series and gallbladder x-ray films, taken prior to her admission were reported as showing a normal upper gastrointestinal tract, and a nonfunctioning gallbladder, with a radiolucent shadow, suggesting a stone.

At operation on April 8, 1953, with a preoperative diagnosis of chronic cholecystitis with stone, a mass was found which was freed, revealing a small atrophic gallbladder. The duodenum was densely adherent to the gallbladder, and a fistula was present between them. The gallbladder was removed, and its site drained. The duodenum was closed transversely. No stones were found. The gallbladder was long, narrow, and had a greatly thickened wall. The first 3 days were stormy, thereafter convalescence was uneventful. The patient subsequently had no further symptoms.

This case, which had been investigated by x-ray examination of both upper gastrointestinal tract and gallbladder, illustrates the difficulties in demonstrating fistulas of this type. It also illustrates what has been re-

ported by others that the gallbladder found in these cases may be contracted, even to the point of obliteration.

CASE 13. L. E., aged 46 years, white, waitress, was admitted on August 13, 1952. The day previous, she had such a severe right upper quadrant pain that she fell to the floor. The pain recurred and radiated to her back. She had chills and fever, but no vomiting. For 1 year 3 years earlier, she had had mild recurrent epigastric pain, but since had been free. Fats aggravated her distress. She was never jaundiced. Examination revealed obesity, marked tenderness, and rigidity but no mass in the right upper quadrant. A flat film of her abdomen showed irregularly scattered gas, but no evidence of obstruction. Gallbladder x-ray films showed a faint concentration of dye in a medium size gallbladder, without evidence of stone. Her white blood count was 12,600, 15 per cent polys, serum amylase 50 units, temperature to 101 degrees F. day.

On August 20, 1952, with preoperative diagnosis of chronic cholecystitis, a markedly thickened gallbladder, containing many small stones, with dense adhesions between it and the duodenum, was found. On dissecting out the gallbladder a large fistula was uncovered into the duodenum. Because of the induration of the duodenal wall it was first believed that an ulcer had perforated into the gallbladder. A 1 centimeter ulcer on the posterior wall of the duodenum was also found. The gallbladder was removed. Because of the size of the duodenal defect and the presence of an ulcer a subtotal gastrectomy was performed. The patient made a rapid recovery, and left the hospital in 10 days.

This case shows how difficult it may be to determine the etiology of a fistula. The conclusion, after reviewing the history and findings, was that this fistula was probably of gallstone origin.

TREATMENT

In the choice of procedures, four objectives appear of paramount importance: (1) to relieve gallstone ileus, if present; (2) to remove the diseased or malignant gallbladder, together with residual stones, if feasible; (3) to close the fistulous opening in the gastrointestinal tract, or do a partial gastrectomy, if peptic ulceration is present; (4) to explore the common duct if jaundice is present.

It is obvious that no single method of combining these procedures can be adopted in all cases. The etiology of the fistula and the patient's condition must be taken into consideration. In poor risk cases with acute obstruction, merely removing the obstructing gallstone may be all that can be safely done at the first operation. One should bear in mind the experience reported by Finney, and look for a second stone especially if the first is faceted. He removed one large faceted stone, but the obstruction recurred and at reoperation, a second large stone was found (5). Three of our cases (Cases 7, 8, and 9) in which only the stone was removed have been followed for 18 months, 1 year, and 5 years respectively. All 3 patients have been apparently well and asymptomatic. In Case 6, after considerable preparation, the obstructing stone was removed from the jejunum, the gallbladder with a second large residual stone was removed, the opening in the duodenum was closed, and a gastroenterostomy was done. The patient tolerated this procedure well and made a rapid recovery. Hematemesis and melena, in this case due probably to the erosion of stones, led to the erroneous suspicion of a primary duodenal ulcer. Faced with this situation again, we probably would omit the gastroenterostomy.

Cholecystectomy was performed in 5 cases, and the fundus of the gallbladder was removed in 1 (Case 11) in which hydrops was present. Drainage of the gallbladder was resorted to in 2 cases. Scarring and contraction of the gallbladder commonly occur, even to the point of almost complete obliteration. In our Case 10, an attempt to remove a small fibrosed gallbladder was abandoned.

Closure of the opening into the gastrointestinal tract may be difficult or unsatisfactory. In Case 2, it was necessary to do a partial gastrectomy and close the duodenal stump about a catheter. In Case 13, a partial gastrectomy was also done, not only because closure of the duodenum would have been difficult, but because a duodenal ulcer was present. In Case 5, closure of the defect in the duodenum was believed to be insecure, and drainage was established

down to it. Excessive bile drainage occurred at first, gradually lessened, and ceased by the ninth day. Thereafter convalescence was rapid.

Exploration of the common duct, even though it may add to the hazard of the operation, may be imperative, especially in jaundiced cases. In our Case 4, a second operation was required to remove a common duct stone, in spite of the fact that at the first operation bile was seen to run freely into the duodenum from the ampulla of Vater.

Bile peritonitis complicated our Case 12. Drainage down to the site of the fistula was established and satisfactory recovery followed.

SUMMARY AND CONCLUSIONS

Thirteen surgical cases of fistulas between the gallbladder and gastrointestinal tract are reviewed and case reports presented. All were due to gallstones. Other much less common causes, peptic ulcer and cancer, are discussed. Most occurred in elderly, obese females.

These fistulas may close spontaneously, either completely or to such an extent that they cannot be demonstrated and give rise to no further symptoms. Such was the case in 3 of our series. Some do persist and in 2 of ours, malignant change developed, and in one, cirrhosis. Some degree of liver damage probably occurs in all.

No characteristic clinical picture was found. Gallbladder disease was simulated in many. Signs and symptoms of intestinal obstruction masked the lesion in others. One of our patients had bile peritonitis. In a number, the fistulas existed for long periods of time without disabling or conspicuous symptoms.

Some of our cases were overlooked in spite of clinical and roentgenographic investigation. Reflux of barium into the gallbladder, air in the biliary tree, and dysfunction or nonvisualization of the gallbladder with the dye were important diagnostic findings.

Treatment must be individualized. Its aim should be the relief of ileus, the removal of the diseased or malignant gallbladder with residual stones, closure of the gastrointestinal defect, and exploration of the common duct if jaundice is present. In poor risk cases, two operations may be advisable, merely relieving the obstruction at the first. There were no surgical deaths.

REFERENCES

1. Beaver, M. G. Cholecystogastrostomy; an experimental study. Arch. Surg., 1929, 18: 899–934.
2. Benjamin, E. G. Carcinoma of the gallbladder, an analysis of 70 cases. Minnesota M., 1948, 31: 537–540.
3. Bennett, L. C., and Hewko, Joseph. Cholecystoduodenal fistula, report of case complicated by complete obliteration of the gallbladder. Am. J. Surg., 1952, 83: 228–232.
4. Clark, Stanley B. Roentgen diagnosis of spontaneous internal biliary fistula. N. York State J. M., 1952, 52: 443–446.
5. Foss, H. L., and Summers, J. D. Intestinal obstruction from gallstones. Ann. Surg., 1942, 115: 721–735. Discussion Geo. G. Finney.
6. Garland, L. H., and Brown, J. M. Roentgen diagnosis of spontaneous internal biliary fistulae, especially those involving common duct. Radiology, 1942, 38: 154–159.
7. Puestow, C. B. Spontaneous internal biliary fistula. Ann. Surg., 1942, 115: 1043–1054.

CYSTIC DUCT REMNANT, A SEQUELA OF INCOMPLETE CHOLECYSTECTOMY

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THE SURGICAL TREATMENT of biliary tract disease began about 90 years ago. In general it may be said that in each decade since cholecystostomy was first practiced and advocated by Bobbs (4) in 1869, there has been wider application of surgical therapy to disease of the biliary tract with an increasing degree of safety for the patient. From time to time many surgeons from various hospitals and clinics throughout the country report on their experience with the surgical treatment of biliary tract disease. These reports in large measure parallel the progress of surgery. The results based on follow-up studies in many of our medical centers are good according to present day standards. To be more specific it may be said that patients with cholelithiasis treated by cholecystectomy have thereafter been symptom-free in 85 to 90 of each 100 patients. This is indeed a commendable accomplishment. However, there is an area for improvement in the 10 to 15 per cent who do not have satisfactory relief of symptoms. Because biliary tract disease associated with gallstones is so common in our population and results in so much disability it is incumbent upon those who treat it to be unrelenting in seeking methods and procedures that will render their efforts more efficient. One approach to this problem is periodically to evaluate our present procedures and the results that are being attained in order to determine how we may improve our accomplishments.

We have interested ourselves in those patients who, either following cholecystectomy done in our own hospital or after operation elsewhere, have had a persistence or a recurrence of symptoms. In the course of the study of these patients we have become convinced that the term "postcholecystectomy syndrome" is an unfortunate one. It indicates something to be expected, something rather regular in a pattern of symptoms that may follow cholecystectomy. Our observations indicate to us that: (1) symptoms which persist are usually due to a condition other than cholelithiasis that was not recognized or properly evaluated prior to cholecystectomy; (2) the recurrence of symptoms is often due to an incomplete operation in which stones are left behind or a remnant of the gallbladder or cystic duct; and (3) the appearance of new symptoms is suggestive of injury to the common duct.

It is our purpose to report our experience with those patients who have had a recurrence of symptoms and in whom there has been demonstrated a remnant of the gallbladder or cystic duct. This represents a 22 year period from September 1, 1932 to September 1, 1954 during which time 3,862 cholecystectomies were performed in the surgical pavilions of The New York Hospital—Cornell Medical Center. Except for the more recent, the majority of the patients have been followed for 3 years or more. During this period we have reoperated upon 13 of these who have had a long cystic duct remnant. We have operated upon and demonstrated a cystic duct remnant in an additional 22 patients who had their primary operation at another hospital, making a total of 35 cases in this series (Table I). Except for 3 private patients of the senior author, this series is made up of ward cases. We have collected an additional 148 cases from the English literature (Table II).

The ages of the patients in our group ranged from 24 to 78 years with a mean age

From the Department of Surgery, The New York Hospital—Cornell Medical Center, New York.

TABLE I.—RECURRENCE OF SYMPTOMS IN 35 CASES

	NYH-CMC	Sex	Age	Primary diagnosis: Chronic cholecystitis	Primary diagnosis: Acute cholecystitis	Primary diagnosis: Cholelithiasis	Primary diagnosis: Choledocholithiasis	Jaundice	Cystic duct remnant visualized on x-ray	Interval between operations, years	Calculi in cystic duct remnant	Choledocholotomy	Choledocholithiasis	Gallbladder remnant	Follow-up in years	Result
1	92066	M	54		+	+		+	—	1	—	—	—	+	—	Death—multiple liver abscesses
2	21984	M	53		+	+		+	—	2 mo.	+	+	—	+	3	Occ. nausea, vomiting, epigastric pain
3	337912	F	38			+		—	—	17	—	—	—	+	6	Well
4	326746	F	34		Unknown			—	—	5	—	+	—	—	7	Occ. mild epigastric pain
5	164695	M	51			+		—	—	7	+	+	+	+	4	Well
6	404954	F	32			+		+	—	5	—	+	—	+	1	Mild intermittent abdominal pain
7	405583	F	67	+		+	+	+	—	2 mo.	—	+	+	—	—	Death—common duct stone
8	326710	M	69		+	+	+	+	—	3	+	—	+	—	—	Death—perforated cystic duct stump
9	140833	F	51	+	+	+		+	—	2	+	+	+	—	2	Well
10	262159	F	47		Unknown			—	+	14	+	—	—	—	7	Well
11	487128	F	63	+		+		+	—	16	—	+	+	—	2	Well
12	311181	F	64		+	+		+	—	2	—	+	+	—	6	Well
13	507050	F	24		Unknown			—	—	2	+	+	—	—	5	Well
14	527044	F	28			+		+	—	8	+	+	+	—	6	Well
15	521813	F	73			+		+	—	23	—	+	+	—	4	Choledocholithotomy 1950—well since
16	504800	F	50			+		+	—	22	—	+	—	—	4	Well
17	4165	F	50	+				—	—	12	—	—	—	—	0	No follow-up
18	374367	M	47		+	+		+	—	7	—	+	+	—	3	Choledochotomy 3 years later. No stones found.*
19	579730	M	65		Unknown			+	—	27	—	+	+	+	3	Has had 3 choledocholithotomies
20	599463	F	65			+		+	—	11	—	+	+	—	3	Well
21	616771	F	65		+	+	+	+	—	5 mo.	—	+	—	—	3	Well
22	584670	F	40	+		+		+	—	8	+	+	—	—	0	No follow-up
23	100701	F	78	+		+		—	—	12	—	+	—	—	2	Well
24	427859	F	52	+		+		—	—	3	—	—	—	+	2	Occ. RUQ pain, nausea, and vomiting
25	624027	F	55	+		+		—	—	12	—	+	—	+	2	Occ. epigastric pain—hiatus hernia
26	587208	M	26		+			—	—	2	—	+	—	—	2	Well
27	448207	F	52	+		+		—	—	2 mo.	—	+	—	—	2	Well
28	67709	F	52	+		+	+	—	—	13	—	+	+	—	2	Well
29	37818	F	48		Unknown			—	+	24	—	—	—	—	1	Well
30	597212	F	47	+		+		+	+	2	—	—	—	—	1	Well
31	678295	F	31	+				—	—	6	—	—	—	—	1	Well
32	498984	F	72		Unknown			—	+	29	+	+	—	+	1	Well
33	653638	F	67	+		+		—	+	1	+	+	—	—		Too recent
34	129423	M	55	+				+	—	19	—	+	—	—		Too recent
35	698549	F	63	+		+		+	—	3	—	+	+	—		Too recent

*See text.

TABLE II.—CYSTIC DUCT REMNANTS

Author	No. of cases	Males	Age range, years	Average age, years	Average interval from cholecystectomy to excision of cystic duct remnant, years	Average interval from cholecystectomy to return of symptoms, years	Jaundice	Choledochotomy	Choledocholithiasis	Calculi in cystic duct remnant
...y and Sharpe 1944)	44	*	*	*	*	*	5(?)	*	11	7
...rson 1946)	42	6	25–74	48	8	3.3	20	*	23?†	23?†
...ms and ...ranahan 1947)	12	*	*	*	*	*	*	*	4	8
...lock and ...furwitt 1951)	30	6	26–71	54	*	*	22	*	*	*
...rton 1954)	20	4	24–73	49	7.4	5.5	11	19	0	2
...sent series	35	8	24–78	52	9.0	3.8	19	26	14	10

*Not specified.
†Does not specify location of stones.

...52 years. Twenty-three or 66 per cent ...ere 50 years of age and over. Of the col...cted series the ages ranged from 24 to 74 ...ears with an average age of 50 years. The ...bservation that cholelithiasis is 4 times ...more frequent in females than males is parallel in both groups. In this series of cystic duct remnants the incidence was 3.4 to 1, and in the collected series it was 4.7 to 1.

Pain is the outstanding symptom of a cystic duct remnant (Table III). For 28 patients in this series pain was the major complaint. Twenty-six or 74 per cent had severe pain, usually colicky in nature; whereas, in the collected series 82 per cent had colicky pain. It was located in the right upper quadrant in 22 instances, in the epigastrium in 14, and radiated to the shoulder in 8.

These individuals were frequently jaundiced. Nineteen or 55 per cent in this series and 43 per cent of the collected cases had jaundice. In 7 of the 19 in this series no common duct stone was demonstrated. Of our series a history of jaundice prior to cholecystectomy was recorded in only 8 patients. Nausea, vomiting, and fatty food intolerance occurred in a relatively high percentage of cases. Several of the patients had anorexia or weight loss. Chills and fever of varying gradations are to be anticipated in those with infection or obstruction in the biliary tree. These symptoms were observed in 20 per cent of the patients both in Peterson's series and in this series.

Three patients had a biliary fistula. In 1 (Case 9) the fistula stopped draining 2 months after operation but 1 year later the patient developed right upper quadrant pain and jaundice. A common duct stone was removed at operation as was the cystic duct remnant. A second patient (Case 26) had had a persistent small amount of biliary drainage for 1½ years from the drain site following cholecystectomy for acute cholecystitis. He had no pain. At operation the fistulous tract communicated with a 4 centimeter cystic duct remnant. In this instance the cystic duct remnant inserted into the right hepatic duct (Fig. 1). Although choledochotomy was performed there were no stones. The third case (Case 1) was a 54 year old patient who developed a biliary fistula following a cholecystectomy for acute cholecystitis. At re-exploration a stone was removed from the liver bed. He subsequently expired and a remnant of the gallbladder was demonstrated at autopsy.

There is frequently a long "lag interval" between cholecystectomy and the development of symptoms. Morton reported a

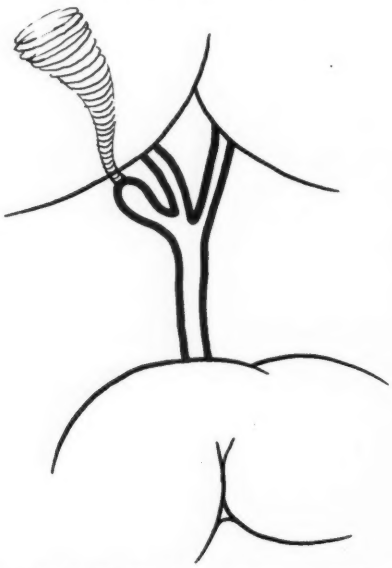

FIG. 1. Case 26. Fistulous tract communicating with the cystic duct remnant which inserted into the right hepatic duct.

patient who went 27 years following cholecystectomy before symptoms developed. We have 1 patient (Case 16) who was asymptomatic for 22 years and then developed severe abdominal pain and jaundice. The average lag interval of this series was 3.8 years whereas in the collected series it was 4.3 years. This asymptomatic interval is again demonstrated in Cases 8 and 35. More important in our experience has been the length of time the patient had symptoms before surgical treatment was undertaken. It is significant that the duration of symptoms prior to surgical treatment or secondary operation averaged 5.8 years. One patient (Case 32) had symptoms for 29 years before a long cystic duct remnant was removed followed by relief.

TABLE III.—SIGNS AND SYMPTOMS OF CYSTIC DUCT REMNANT

	No. of cases
Total cases	35
Major complaint	
Pain	28
Jaundice	6
Fistula	1
Pain	
Mild	6
Severe	26
Right Upper Quadrant	22
Epigastric	14
Right Scapula	8
Jaundice	19
Nausea and vomiting	18
Fatty food intolerance	13
Chills and fever	7
Anorexia	6
Weight loss	6

Symptoms associated with a cystic duct remnant are not sufficiently pathognomonic to establish a diagnosis; however, any patient who has had a cholecystectomy and complains of severe recurrent right upper quadrant or epigastric pain should be suspected of having a cystic duct remnant. If, in addition, the pain radiates to the shoulder, or if the patient has fatty food intolerance, anorexia, nausea, vomiting, or jaundice and fever it is even more suggestive that a cystic duct remnant is present. Although the symptoms are comparable to those for which the cholecystectomy was done, we have repeatedly observed a higher incidence of jaundice and the fact that the pain is usually more severe, symptoms similar to those frequently found with common duct stones.

The differentiation of symptoms associated with a cystic duct remnant and a common duct stone may be difficult or impossible. In the former the attacks frequently have been occurring for many years, slowly increasing in severity with each successive attack; whereas with a common duct stone there is sometimes a more abrupt onset of symptoms. There is usually a long lag following cholecystectomy before symptoms develop in patients with a cystic duct remnant. Why a cystic duct remnant should lie dormant for many years and then begin to cause symptoms is without evident explanation.

Likewise, an explanation for the high incidence of jaundice is lacking. One may reason that a common duct stone was passed prior to surgery in some of the 7 in which no stone was found. Pressure on the common duct by a dilated cystic duct remnant with or without stones is an unlikely but a possi-

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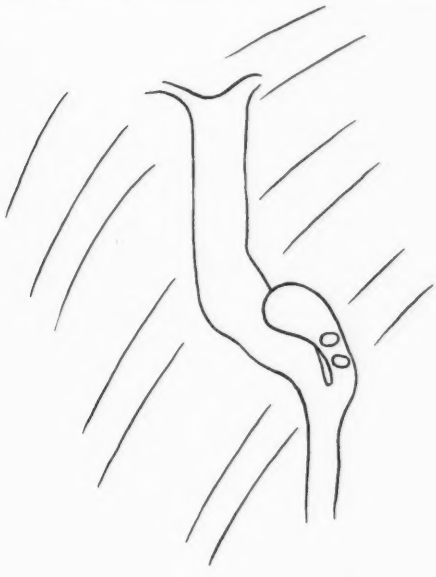

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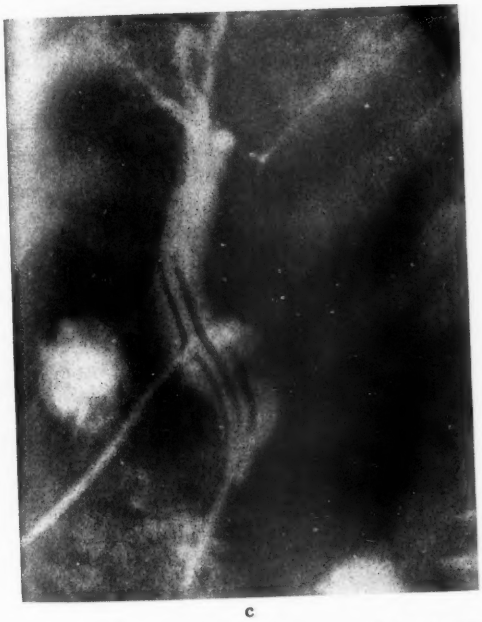

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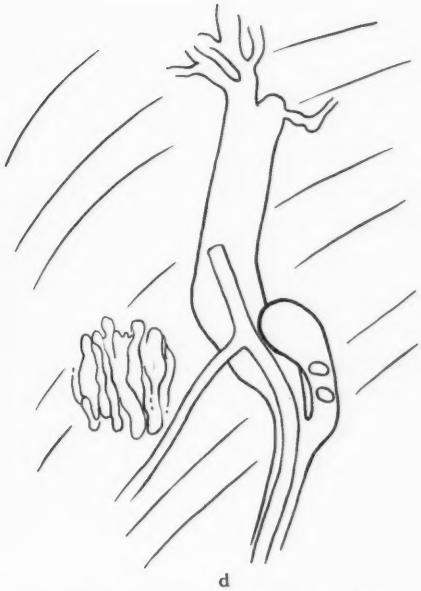

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FIG. 2. Case 33. a, Intravenous cholangiogram showing a cystic duct remnant with stones inserting into the medial aspect of the common duct. b, Line drawing of a. c, Operative cholangiogram. In comparison note how well the structures were demonstrated on the intravenous cholangiogram. d, Line drawing of c.

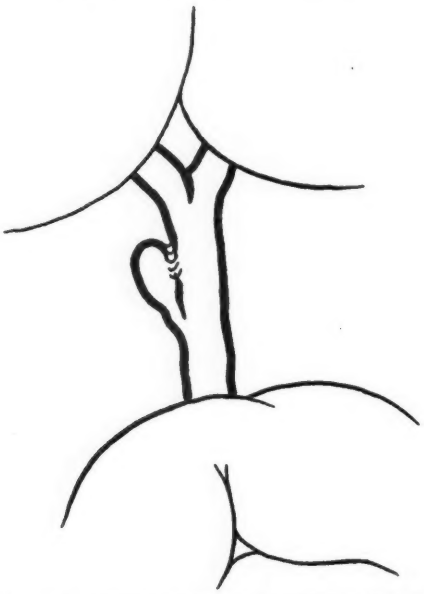


FIG. 3. A common position of the cystic duct remnant; adherent to a slightly dilated common duct.

ble cause. Although common duct stones were found in the remaining 12 patients, the stones may have formed in the cystic duct, then passed into the common duct producing obstructive jaundice.

Womack has expressed the belief that the symptoms in patients who have a cystic duct remnant are not due to the duct per se but are caused by the numerous nerve endings found in the scar tissue about the cystic and common duct. He also expressed the opinion that as a result neuromas developed leading to pain and malfunction of the sphincter of Oddi. We too have observed the number of large nerves found around the cystic duct remnant (Fig. 8b). It seems logical to remove the scar tissue around these ducts Whether or not this is a cause of the symptoms remains a matter of speculation

ROENTGEN EXAMINATIONS

Cholecystography was attempted in 17 patients of this series. Thirteen of these were by the oral method, 7 showing no concentration of the contrast agent in the biliary system. In 3 the cystic duct remnant was visualized and in the remaining 3 a gallbladder remnant was seen.

Subsequent to the introduction of cholografin in 1953, intravenous cholangiograms have been performed at this center by John McClenahan on 121 patients following cholecystectomy. Cystic duct remnants were demonstrated in 24 patients. In 6 of the 24, symptoms could reasonably be attributed to other lesions such as chronic duodenal ulcer and hiatus hernia. In 18 individuals there were no other evident causes of the patients' persistent symptoms. Many were patients referred from elsewhere for special examination; therefore, they are not recorded in this paper. Only a few were operated upon, 2 of whom are in this series (Cases 32 and 33) (Figs. 2 and 9). There were 2 additional patients in this series who had intravenous cholangiography but the cystic duct was not visualized.

OPERATIVE FINDINGS

In many textbooks of anatomy the cystic duct is shown inserting into the lateral side of the common duct midway between the junction of the right and left hepatic duct

FIG. 4. Case 15. The cystic duct remnant inserts into the common duct as it passes posterior to the duodenum.

and the ampulla. Maingot reports that the cystic duct opens into the medial, anterior, or posterior surface of the common duct in 8 to 10 per cent of cases. By intravenous and operative cholangiography the cystic duct was shown to insert into the medial aspect of the common duct in 2 cases (Figs. 2 and 9) although at operation it was described as inserting into the lateral aspect. An explanation of this discrepancy is not evident although it may be due to the distortion of the common duct at the time of operation. The cystic duct remnant is usually found joining the common duct laterally with its tip adherent to the common duct (Fig. 3).

Congenital anomalies of the duct system were described in 4 patients or in 11 per cent of this series. In 1 case (Case 15) the cystic duct arose from the common duct just as it went behind the duodenum (Fig. 4). This anomaly is emphasized by Flint. In another (Case 9) the cystic duct emptied into the right hepatic duct (Fig. 1). An incidental anomaly was an accessory right hepatic duct entering the common between the cystic and right hepatic ducts (Case 13) (Fig. 5). In a fourth patient (Case 32) an intravenous cholangiogram (Fig. 9) gave the surgeon a warning that something was amiss. At operation there was an accessory duct extending from the right hepatic to the cystic duct.

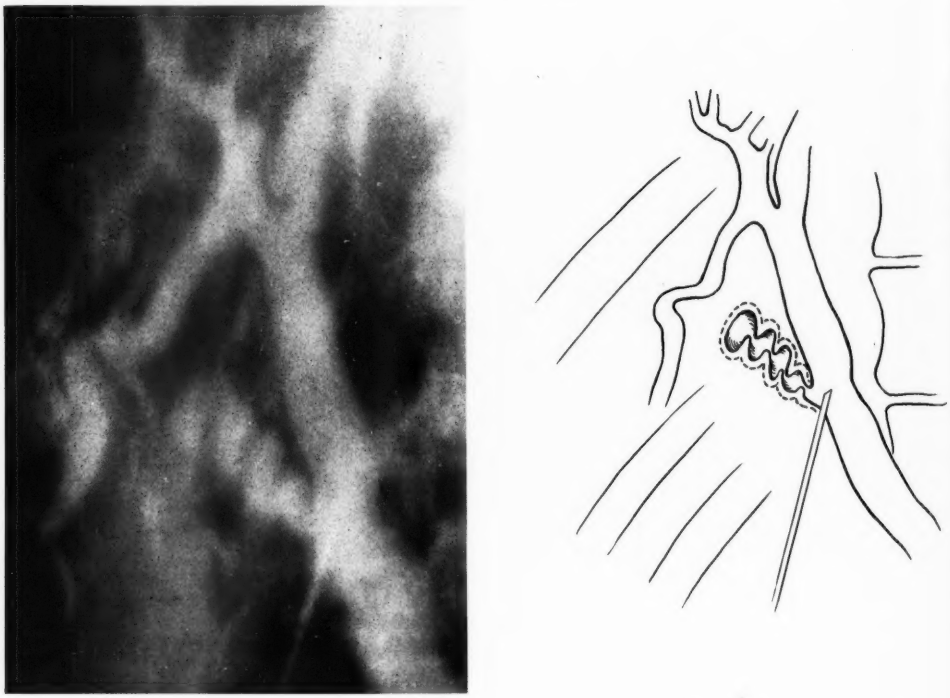
The findings in association with the cystic duct remnant vary greatly (Table IV). In 10 of the 35 cases in this series (Table I) and in 17 of the 76 cases in the collected series (Table II) stones were present in the cystic duct remnant. This gives a total of 24 per cent of the cystic duct remnants with calculi. Case 10 is presented as a representative case. Common duct stones are also frequent, being found in exactly one-half of the 26 choledochotomies. Only 15 of the 76 patients in the collected series had calculi in the common duct. Morton found no stones even though he performed a choledochotomy in 19 of his 20 cases, and of these 11 patients had been jaundiced. Case 35 is representative of the patients who had choledocholithiasis.

FIG. 5. Case 13. An accessory right hepatic duct inserting into the common duct posteriorly and a long cystic duct remnant.

In the earlier cases some of the specimens were not examined by the pathologist. Of the 24 that were, changes of acute or chronic inflammation were present in all but 3. The size of the remnants varied a great deal. They ranged from 2 to 5 centimeters in length and from 0.5 to 3 centimeters in diameter.

Although the operative note described cholecystectomy as having been done at the primary operation, a gallbladder remnant was found in 8 patients in this series. The cystic duct remnant and the common duct were usually dilated regardless of whether or not stones were found in the common duct.

The variations of location of the junction of the cystic with the common duct as found in our series suggest that they account for a certain number of the cystic duct remnants. Should the cystic duct have an unusual insertion and if at cholecystectomy the surgeon does not dissect the cystic duct to its true junction with the common duct, a long remnant would result. Anyone who performs an operation on the biliary system should,



a b

FIG. 6. Case 21. a, An operative cholangiogram demonstrating prominent valves of Heister in the cystic duct remnant. b, Line drawing of a.

therefore, be familiar with the anomalies and many variations that may occur.

The discussion as to whether or not stones found in the cystic duct were formed there or were residual stones, which were present but not removed at the time of cholecystectomy, remains one of controversy. Clute believed that these stones were present at the time of cholecystectomy, whereas Garlock believed that the cystic duct remnant in effect became a diseased gallbladder capable of forming stones. Following cholecystectomy the common duct dilates and takes over the reservoir function of the gallbladder. It has been shown that if a long cystic duct remains it also dilates. It is conceivable that without the contractile power of the gallbladder forcing the bile into the common duct the valves of Heister (as in Fig. 6) might prevent complete evacuation of a cystic duct remnant. As found by Cole and substantiated by this series the cystic duct remnant is usually the site of chronic inflammation. Stasis and infection are associated with the formation of stones. If one accepts the concept that stones form in the cystic duct remnant then the high incidence of choledocholithiasis is explained. A stone in the cystic duct might easily pass into the common duct.

CASE REPORTS

Symptoms 18 Years Following Cholecystectomy

CASE 34. N.Y.H. No. 12 94 23. A 55 year old male had had a few instances of attacks of epigastric pain, sometimes with fainting, following a cholecystectomy done 19 years before this admission. The pain had been gradually increasing in severity. During the week prior to admission he had had an attack of severe pain associated with jaundice and fever. Intravenous cholangiography revealed a dilated common duct. At operation a cystic duct remnant, 2.5 by 1.5 centi-

a b

FIG. 7. Case 34. a, The cystic duct remnant inserts into the posterior surface of the common duct. The common duct is markedly dilated. b, Photomicrograph of the wall of the cystic duct remnant showing the fibrous tissue and the clusters of lymphocytes. Hematoxylin and eosin, ×100.

ters which arose posteriorly from the common duct was removed (Fig. 7a). Although the common duct was dilated there were no stones found. Pathologic examination showed clusters of lymphocytes in the fibrotic wall of the cystic duct remnant (Fig. 7b). The patient has been well during the short period since operation.

This case demonstrates an acute flare-up of symptoms 19 years following cholecystectomy. It is likely that this patient had a cystic duct stone which caused his intermittent attacks. The attack just prior to admission associated with jaundice for the first time may have been due to the passage of a stone into the common duct, which later was passed into the duodenum.

Perforation of the Cystic Duct Remnant

CASE 8. N.Y.H. No. 32 67 10. A 69 year old male had had a cholecystectomy and choledocholithotomy 3 years previously for subacute cholecystitis, cholelithiasis, and choledocholithiasis. The gallbladder had been removed with the dissection beginning at the cystic duct and removing the gallbladder in a retrograde fashion. The patient was asymptomatic for 3 years and until 20 days following a cataract extraction when he suddenly developed paraumbilical pain, nausea, and vomiting, followed by fever and jaundice. At operation he was found to have a bile peritonitis; because of his general condition only local drainage was established. The patient expired on the first postoperative day. At autopsy the common and cystic ducts were dilated and contained stones. The cystic duct had an 8 by 3 millimeter perforation (Fig. 8a). Pathologic examination revealed numerous lymphocytes, fibroblastic and capillary proliferation, but no acute inflammatory process (Fig. 8b).

This case demonstrates that in the aged perforation of the biliary tract may take place with minimal evidence of inflammation either clinically or on gross or microscopic examination. Perforations and a resulting fatal

TABLE IV.—PATHOLOGY AT OPERATION

	No. of cases
Cystic duct remnant not containing stones	25
No other pathology	11
Choledocholithiasis	8
Gallbladder remnant	6
with cholelithiasis	3
without cholelithiasis	3
Cystic duct remnant containing stone(s)	10
No other pathology	4
Choledocholithiasis	3
Gallbladder remnant	3
with cholelithiasis	0
without cholelithiasis	3
Perforated	1

a b

FIG. 8. Case 8. a, A perforated cystic duct remnant with stones in the cystic and common duct. b, Photomicrograph of the wall of the cystic duct remnant showing the dense lymphocytic infiltration, capillary proliferation, and numerous large nerves. Hematoxylin and eosin, ×25.

bile peritonitis are not infrequent in old age patients with acute obstructive cholecystitis.

Anomalous Duct, Incomplete Cholecystectomy, and Cholelithiasis Demonstrated by Intravenous Cholangiogram

CASE 32. N.Y.H. No. 49 89 94. A 72 year old female had had a cholecystectomy 29 years prior to admission. Thereafter she continued to have mild recurrent right upper quadrant pain and nausea unrelated to food. One year and again at 3 months prior to admission she had attacks of colicky right upper quadrant pain lasting 24 hours and accompanied by mild chills. Intravenous cholangiogram (Fig. 9a) was interpreted preoperatively as showing a long cystic duct in an anomalous position with a stone presumably in the gallbladder remnant. At operation an anomalous right hepatic duct drained into the cystic duct; the gallbladder remnant contained a large stone (Fig. 9c).

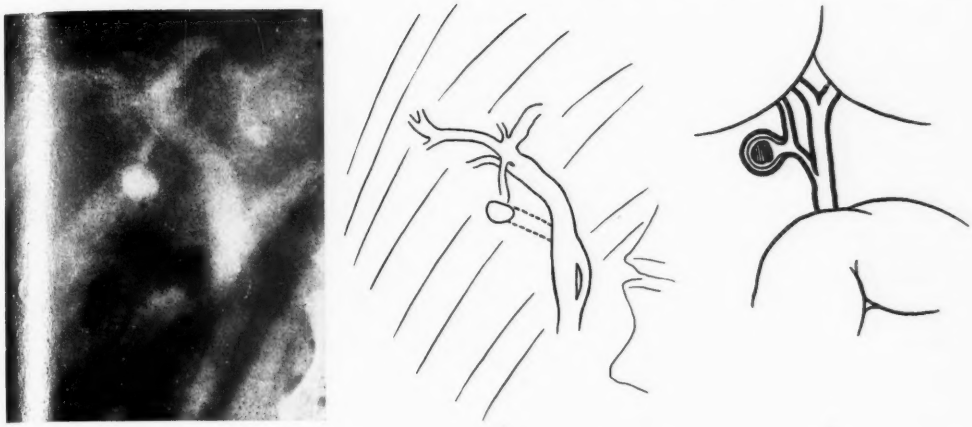
This case is an example of the long period of time some of these patients have symptoms before they are treated surgically. Also it demonstrates the value of an intravenous cholangiogram in anticipating an anomaly of the extrahepatic biliary system.

Calculi in Cystic Duct Remnant

CASE 10. N.Y.H. No. 20 21 59. A 47 year old female had had a cholecystectomy 14 years prior to this admission. She had continued to have episodes of right upper quadrant pain radiating to the back and right shoulder relieved only by morphine. Oral cholecystogram demonstrated a cystic duct remnant. At operation a 4 by 3 centimeter cystic duct remnant with 3 small stones was removed (Fig. 10). The common duct was not dilated; therefore, a choledochotomy was not performed. She has been well since her operation 7 years ago.

Cystic Duct Remnant with Associated Common Duct Stones

CASE 35. N.Y.H. No. 69 85 49. A 63 year old white female had had a cholecystectomy 3 years previously. She had been asymptomatic until 3 months before ad-



a b c

FIG. 9. Case 32. a, Intravenous cholangiogram showing a calculus in the gallbladder remnant and an anomalous duct from the right hepatic to the cystic duct. b, Line drawing of, a, with dotted lines to show course of cystic duct found at operation but not visualized on x-ray film. c, Sketch of findings at operation.

mission when she began to have attacks of epigastric pain radiating to the back after meals. Twelve hours prior to admission she had an attack of pain similar to the preceding ones except much more severe, a temperature of 39.5 degrees C., and a serum amylase of 320 units. She soon became slightly jaundiced. Intravenous cholangiogram revealed a narrowing of the common duct just before the ampulla. At operation the common bile duct was dilated and 2 stones were found. A cystic duct 1.5 by 2 centimeters which arose from the lateral aspect of the common duct in its midportion and was densely adherent to the common duct was excised (Fig. 11). The specimen had prominent valves of Heister and microscopically revealed chronic choledochitis. In the short interim since operation the patient has been well.

It is probable in this instance that the common duct stones were formed in the cystic duct remnant.

SURGICAL TREATMENT

Patients suspected of having a cystic duct remnant should be evaluated in a careful and thorough manner before operation is embarked upon. Once the diagnosis has been relatively well established, however, surgical therapy should not be withheld unless there is some contraindication to operation. Intravenous cholangiography is of great value to the surgeon in anticipating the position of the cystic duct remnant as well as anomalies of the extrahepatic biliary system.

Although we usually use a right subcostal incision any incision that gives the surgeon the best exposure is the one of choice. A careful exploration of the abdominal cavity is done to determine the presence or absence of other conditions that may have simulated the symptoms of those commonly associated with a cystic duct remnant. Meticulous dissection that enables one to identify unequivocally the structures in this area is essential if anomalies are to be demonstrated. Damage to the ductal system and the adjacent blood vessels in this vicinity carries with it severe consequences; therefore, the surgeon who undertakes this procedure must be well versed in the anatomy and anatomic variations that may be encountered.

We have found it convenient first to expose the common duct and then an attempt is made to visualize the tip of the cystic duct remnant. If difficulty is encountered an operative cholangiogram may demonstrate it. Probe dilators may be used to advantage in exploring the common duct for the entrance of the cystic duct. Although dissection of the cystic duct may be difficult due to the dense

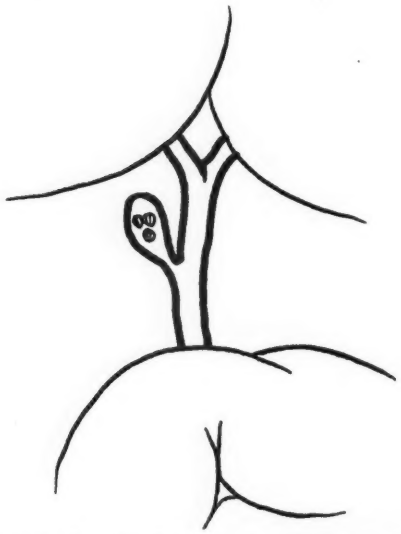


FIG. 10. Case 10. Cystic duct remnant containing calculi.

adhesions, the junction with the common duct must be clearly demonstrated.

Although we did not explore the common duct in 9 of the cases in this series we are now convinced that the presence of a cystic duct remnant is an indication for choledochotomy. The high incidence of common duct stones in this series bears this out. In one-third of this series and one-half of the cases in which a choledochotomy was performed common duct stones were found. Nineteen patients or over one-half of this series had stones either in the cystic or common duct.

If the common duct is explored one may provide for decompression by using a T tube or by placing a small catheter into the stump of the cystic duct. In either event the cystic duct remnant should be divided or ligated within 5 millimeters of its true junction with the common duct. If a T tube is used the long arm is brought out through the opening in the common duct which is closed about it, and the cystic duct is ligated and transfixed. If one wishes to use a small catheter placed through the cystic duct into the common duct then the choledocholithotomy opening is closed and the catheter is secured by a fine ligature of catgut.

Postoperative care is the same as accorded those having had a choledochotomy. A cholangiogram should always be done before removal of the T tube on the eighth or ninth day.

RESULTS

There are 27 patients in this series who have been adequately followed (Table I). Nineteen or 70 per cent consider themselves well. Five still have complaints, none of which are incapacitating. We cannot be sure that these are of biliary tract origin. Sixty to 96 per cent of the patients in the collected series are considered well following removal of the cystic duct remnant. Three patients of this series underwent further surgery of the biliary tract, common duct stones being found in 2. The third patient (Case 18) 3 years after excision of the cystic duct remnant developed right upper quadrant pain and jaundice. He was re-explored and choledochotomy revealed no stones; however, a 4 centimeter cystic duct remnant still remained and was re-excised. At present this patient has no symptoms. It should be noted that there were no injuries to the common duct even though the operation was frequently much more difficult than the original cholecystectomy because of the dense adhesions.

Fifteen of the patients had a cystic duct remnant without associated gallbladder remnant or choledocholithiasis. Three of these had stones in the cystic duct remnant. All but 1 of these patients consider themselves well.

There were 3 deaths. One (Case 7) was that of a 67 year old female who had persistent jaundice following cholecystectomy and choledocholithotomy. One month later she was re-explored and a choledochotomy was performed, no stones being found. At autopsy there was a common duct stone and a cystic duct remnant. The second (Case 1) was of a 54 year old male who had a cholecystectomy for acute cholecystitis. Following

operation a biliary fistula developed which later closed spontaneously and gave rise to pain, chills, and fever. At re-exploration a stone was found in the liver bed. Postoperatively the patient ran a progressively downhill course and expired on the seventh postoperative day. At autopsy there were multiple liver abscesses and a remnant of the gallbladder and intact cystic duct. The third death (Case 8) was of a 69 year old male who years after a cholecystectomy and choledocholithotomy died of a bile peritonitis resulting from a perforation of the cystic duct remnant.

DISCUSSION

Cystic duct remnants are the result of an inadequate cholecystectomy. An accurate understanding of the anatomy of the region and its common variations should keep us alert in operative procedures upon the biliary tract. Meticulous dissection facilitated by adequate exposure enables one to ligate the cystic duct readily and safely within 5 millimeters of its true junction with the common duct. In acute cholecystitis the various structures may be obscured by inflammatory reaction, and more time and care are required to identify them, but it need not be difficult. Perhaps one of the most frequent reasons for incompletely removing a cystic duct is to be found in its anatomic variations. For example, a long cystic duct which extends parallel to and enters the common duct nearer the ampulla of Vater than usual, if not dissected clearly to its true junction, may be transected too close to the gallbladder thus leaving a long remnant. We have also observed that the cystic artery and cystic duct are often held together by scar tissue so that, in dissecting the 2 apart, hemorrhage may occur. This circumstance influences some surgeons to clamp and ligate these structures together. When this is done there is a likelihood that the cystic duct will not be sufficiently dissected to demonstrate its true relationship to the common duct.

When cholecystectomy is performed first by identifying and dissecting the cystic duct

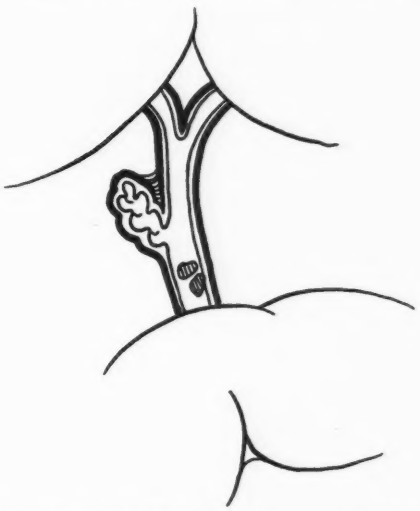


FIG. 11. Case 35. The cystic duct remnant has prominent valves of Heister and the common duct contains 2 calculi.

so that a ligature may be placed about it and then by dissecting and temporarily ligating the cystic artery near its entrance into the gallbladder wall, followed by removal of the gallbladder from the fundus downward, the cystic artery is readily separated from the cystic duct by sharp dissection and the cystic duct is easily traced to its junction with the common duct. We think that this is a safe method for doing a complete cholecystectomy and one that enables the operator to leave the proper length of the cystic duct. Cystic duct remnants may cause no symptoms; they may be the site of pathologic changes, acute or chronic inflammation with or without calculi. They may be associated with common duct changes, including stones. Twenty-nine per cent of those patients with cystic duct remnant also had cystic duct calculi which seems to be too high an incidence to have been overlooked by the surgeon who did the cholecystectomy. In addition to the stones causing symptoms while in the cystic duct remnant they are capable of becoming common duct stones. A good result following mere excision of the cystic duct remnant speaks for itself. The symptoms caused by

the cystic duct remnant in the usual case are characteristic enough that its presence should be suspected. With the advent of intravenous cholangiography this diagnosis can be substantiated in many cases. Caution should be exercised, however, in ascribing to a cystic duct remnant all symptoms demonstrated by x-ray examination. Some patients have an asymptomatic cystic duct remnant and their symptoms are due to other conditions which should be searched for by a thorough reevaluation before a diagnosis of cystic duct remnant is made for atypical symptoms.

That there is a general lack of understanding of the symptoms caused by a cystic duct remnant is suggested in this series by the length of time patients had symptoms before surgical treatment was embarked upon. This fact is evident also in the collected series by the time interval from the return of symptoms until the removal of the cystic duct remnant (Table II).

The frequency with which jaundice has been reported by other authors has been confirmed. Actually, this series has a greater incidence of common duct stones than has previously been reported. In some of the patients in this group the cystic duct remnant was removed as an incidental finding at the time of choledochotomy. However, in retrospect the cystic duct may have been the source of the common duct stones or, in the cases in which no stone was found, of the patient's symptoms. Until recently we have not sufficiently evaluated the cystic duct remnant as the cause of a patient's symptoms following cholecystectomy; therefore, it has been frequently overlooked until the patient had choledocholithiasis. Although we anticipate a relative decrease in the incidence of overlooked common duct stones with the aid of a better diagnostic means, it is likely that they will remain as one of the problems that confront those who operate upon the biliary tract. Stones formed in the cystic duct can easily enter the common duct. The fact that Morton found no stones in the common duct may indicate that he removed the cystic duct remnant before stones were formed.

In any discussion of the persistence or recurrence of symptoms following cholecystectomy, one cannot ignore the term "postcholecystectomy syndrome." We have attempted to avoid use of the term because we believe it to be misleading since it indicates a clinical entity that occurs as the result of cholecystectomy. If the symptoms were due to gallbladder disease and symptoms persist we believe that an incomplete operation was performed, a portion of the gallbladder, a cystic duct remnant, or a common duct stone being the most frequent causes for a persistence of symptoms. On the other hand, if the symptoms were not associated with biliary tract disease but were due to peptic ulcer, hiatus hernia, renal conditions, coronary heart disease, or pancreatitis or some neurologic disorder, then it is a matter of inaccurate diagnosis. So we emphasize that while a cystic duct remnant may be the cause of symptoms if it develops into a "reformed gallbladder" capable of being the site of disease, it may exist without pathologic changes and symptoms, and is, therefore, to be considered as but one of the possible explanations for persistence or recurrence of symptoms following cholecystectomy.

SUMMARY

1. Thirty-five cases of cystic duct remnant at The New York Hospital-Cornell Medical Center and an additional 148 cases from the literature have been reviewed.

2. A cystic duct remnant is the result of an inadequate cholecystectomy.

3. A cystic duct remnant may be the cause of symptoms indistinguishable from those of gallbladder disease. The persistence or the reappearance of symptoms following cholecystectomy for cholelithiasis should lead one to suspect a cystic duct remnant.

4. Intravenous cholangiography is a valuable adjunct in demonstrating indirectly and directly evidence of a cystic duct remnant.

5. Patients who have a persistence or a recurrence of symptoms following chole-

cystectomy should be carefully re-evaluated. A cause may be demonstrated in a high proportion; a cystic duct remnant is but one of several conditions that may be the basis for their complaints.

6. An appreciation of the anatomic variations of the cystic duct in relation to the common duct and greater attention to the technique of cholecystectomy on the part of the surgeon should decrease the incidence of cystic duct remnants.

REFERENCES

1. Adams, R., and Stranahan, A. Cholecystitis and cholelithiasis; an analytic report of 1,104 operative cases. Surg. Gyn. Obst., 1947, 85; 776–784.
2. Clute, H. M. Cystic duct stones after cholecystectomy. Surg. Clin. N. America, 1933, 13: 603–607.
3. Cole, W. H., and Rossiter, L. J. The relationship of lesions of the cystic duct to gall bladder disease. Am. J. Digest. Dis., 1938, 5: 576–586.
4. Cutter, I. S. John Stough Bobbs and lithotomy of the gall bladder. Surg. Gyn. Obst., Inter. Abstr. Surg., 1928, 47: 409–411.
5. Flint, E. R. Abnormalities of the right hepatic, cystic and gastroduodenal arteries, and of the bile-ducts. Brit. J. Surg., 1923, 10: 509–519.
6. Garlock, J. H., and Hurwitt, E. S. The cystic duct stump syndrome. Surgery, 1951, 29: 833–841.
7. Gray, H. K., and Sharpe, W. S. Biliary dyskinesia: the role played by a remnant of the cystic duct. Proc. Mayo Clin., 1944, 19: 164–168.
8. Maingot, Rodney. Abdominal Operations. 3rd ed. New York: Appleton-Century-Crofts, Inc., 1955.
9. McClenahan, J. L. Personal communication.
10. Morton, C. B., II. Post-cholecystectomy symptoms from cystic duct remnants. Ann. Surg., 1954, 139: 679–682.
11. Peterson, F. R. Re-formed gall bladder; a review of 42 cases. J. Iowa M. Soc., 1946, 36: 134–138.
12. Womack, N. A., and Crider, R. L. The persistence of symptoms following cholecystectomy. Ann Surg., 1947, 126: 31–55.

SUCCINIC DEHYDROGENASE ACTIVITY, PROTEIN BOUND SULFHYDRYL AND DISULFIDE GROUPS IN SQUAMOUS CELL CARCINOMA OF THE SKIN

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ANALYSES of the differences and similarities (microscopic, chemical, and biologic) of neoplastic cells and their nonneoplastic homologues afford a basic approach to the cancer problem. Comparisons of microscopic pattern of neoplastic and nonneoplastic cells are of daily practical importance in the diagnosis of tumors and the management of cancer patients. Comparisons of chemical pattern are still largely in the field of research but implications of practical import can be drawn. Great stimulus in this field is afforded by the development of methods for the direct microscopic visualization of the presence of certain specific chemical substances or their sites of activity in the tissues themselves. Many of these are vitally concerned with the growth and function of normal and neoplastic cells.

Succinic dehydrogenase plays a vital role in the respiratory processes of most living cells and forms a link in the chain of reactions concerned with the oxidation of lipids, carbohydrates, and proteins, as Seligman and Rutenburg have shown. Sites of succinic dehydrogenase activity have been found to correlate with regions of cell growth in various contexts. In the uterine cervix manifestation of this enzyme activity occurs in the basal layer of normally maturing portio vaginalis epithelium, but is found more diffusely through metaplastic epithelium and in squamous cell carcinoma, as was demonstrated in a previous article (9).

Protein bound sulfhydryl groups are essential for the activity of many enzymes. They serve as protein links and are important in various cell functions. Barron has emphasized that sulfhydryl groups have an important function in cell division and growth (4). In experimental studies it has often been found that the sulfhydryl group content of tumor tissue is greater than in nontumorous tissue. Normal epidermis contains in some of its layers a high concentration of sulfhydryl groups which can be detected by histochemical means, as Rudall has indicated. As epidermal cells mature and keratinization develops, the concentration of disulfide groups becomes more prominent.

The present study is concerned with the localization of these vital metabolic substances in squamous cell carcinoma of human skin. In 38 cases of squamous cell carcinoma the sulfhydryl reaction occurred in all of the viable neoplastic cells. The disulfide reaction was found in regions of intracellular keratinization and in epithelial pearls. Dehydrogenase activity was present in considerable degree in all of the viable neoplastic cells but was much diminished in the presence of intracellular keratinization. It was not detectable in epithelial pearls.

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MATERIALS AND METHODS

Tissue blocks to include normal and neoplastic epithelium were obtained from 38 cases of squamous cell carcinoma of the

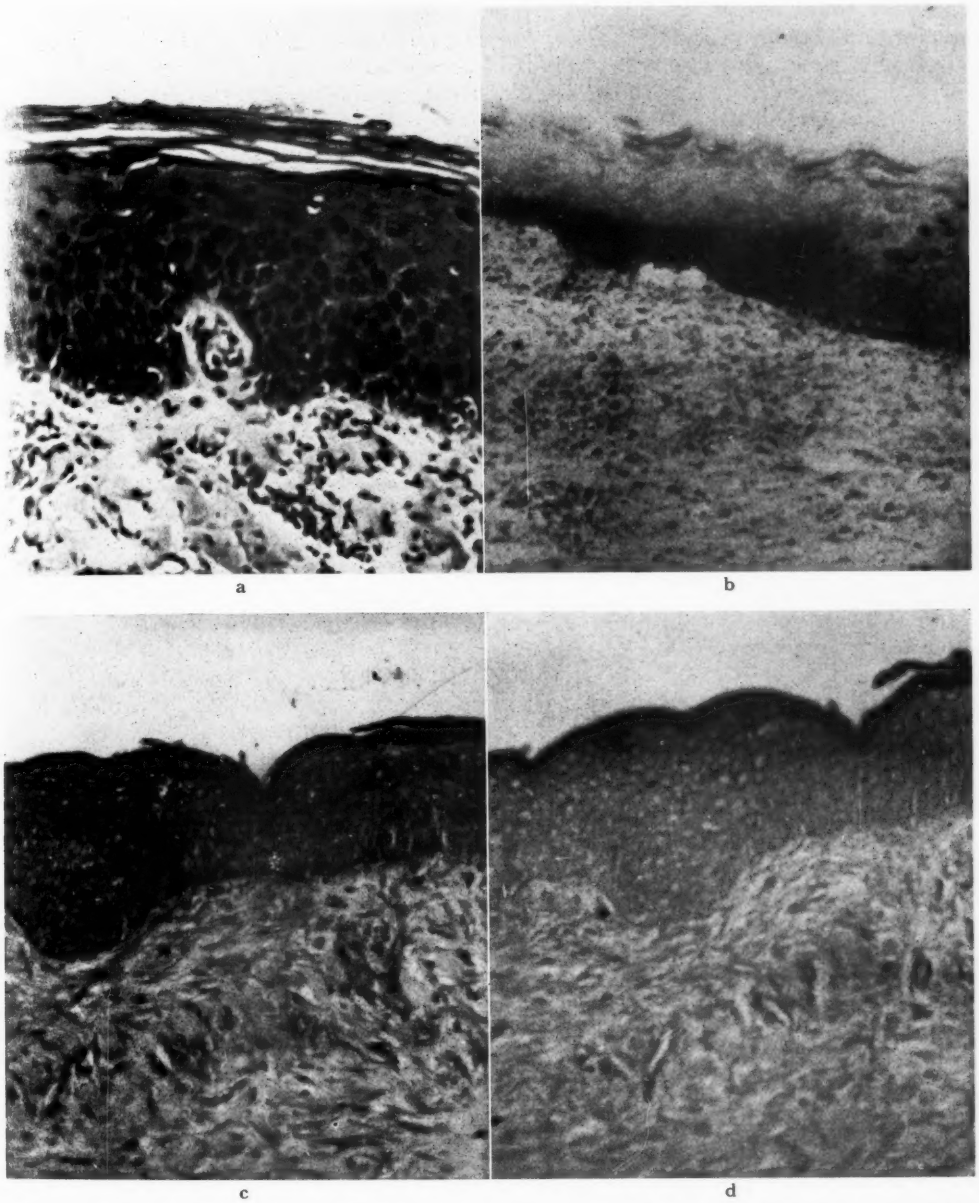


FIG. 1. Normal epidermis. All sections, ×115. a, Hematoxylin and eosin section. For comparison with special stains. b, NT section. Tissue from same case incubated in neotetrazolium with succinate to demonstrate sites of dehydrogenase activity. Black crystals and granules (formazan) are seen in cytoplasm, most heavily in basal layer, diminishing progressively in more superficial layers. c, SH section. Tissue from same case processed to show localization of sulfhydryl (SH) groups. Staining of nucleoli and cytoplasm of epidermal cells. Somewhat heavier staining of superficial keratinizing cells. d, SS section. Tissue processed to show localization of disulfide (SS) groups. Very little staining of deeper cell layers. Considerable staining of superficial keratinizing cells.

skin. For sulfhydryl localization the technique of Barrnett and Seligman (1) was employed. Disulfide was detected by treating sections overnight with 0.1 M sodium iodoacetate to block pre-existing sulfhydryl groups and, after washing, next immersing the slides in 10 per cent sodium acetate and 5 per cent sodium sulfite solution. After washing, the procedure for sulfhydryl localization was applied.

Dehydrogenase activity was localized by incubating fresh tissue blocks anaerobically at 37 degrees C. for 1 hour in solutions containing 0.23 per cent neotetrazolium (NT) (10), 0.81 per cent sodium chloride, 0.03 M sodium succinate and 0.09 M phosphate buffer, *p*H 7.4 (7). Control blocks were incubated in a similar solution except that 0.03 M sodium malonate was used instead of sodium succinate to inhibit the succinic dehydrogenase reaction, according to the method of Quastel and Wheaton. Sections from all blocks were stained with hematoxylin and eosin for comparison.

RESULTS

In the sulfhydryl preparations the specific reaction was indicated by red to blue staining of cytoplasm and nucleoli. Similar staining was found in the sections prepared to show disulfide groups. Sites of succinic dehydrogenase activity were manifested by deposition of black or brown crystals or granules (formazan) in the cytoplasm of the cells, as Shelton and Schneider demonstrated. Areas of weaker reaction occasionally revealed red microdroplets rather than crystals.

In every case normal epidermis was studied for comparison (Fig. 1). Evidence of dehydrogenase activity was strongest in the basal layer of the epidermis (Fig. 1b). Enzyme activity was less prominent in the granular layer and was absent in the keratinized cells. The sulfhydryl reaction occurred in all of the epidermal cells in the basal, malpighian, and granular layers (Fig. 1c). As evidence of intracellular keratinization appeared, the sulfhydryl reaction was slightly stronger. In keratinized surface epithelium, moderate sulfhydryl reaction was discernible. The disulfide reaction was not seen in the deeper epidermal layers (Fig. 1d). Toward the surface, as intracellular keratinization occurred, moderate disulfide reaction became manifest. In keratinized surface epidermis a strong blue staining indicating disulfide reaction was seen.

Invasive squamous cell carcinoma showed a histochemical reaction pattern varying with the degree of differentiation (Fig. 2). Proliferating cells in the invasive strands contained evidence of dehydrogenase activity (Fig. 2b), and sulfhydryl groups (Fig. 2c), but had a lesser degree of disulfide reaction (Fig. 2d).

Well differentiated squamous cell carcinoma (Fig. 3) revealed a histochemical reaction pattern analogous to that of epidermis. Evidence of dehydrogenase activity occurred in considerable degree in all the viable neoplastic cells (Fig. 3b). The reaction was maximal at the periphery of the advancing neoplastic masses. Toward the center of tumor formations, as intracellular keratinization appeared, evidence of dehydrogenase activity became less prominent. No dehydrogenase activity was found in epithelial pearls. The sulfhydryl reaction occurred in all the neoplastic cells (Fig. 3c). As evidence of intracellular keratinization appeared, the reaction became slightly stronger. The disulfide reaction (Fig. 3d) was found mostly in epithelial pearls and in regions of intracellular keratinization.

In less well differentiated carcinoma, with little evidence of keratinization, the reaction pattern was somewhat different. Again evidence of dehydrogenase activity was found in all of the viable neoplastic cells. It was more marked at the periphery than in the center of tumor strands, even though there was no discernible evidence of keratinization. Sulfhydryl reaction occurred in all of the viable neoplastic cells but was not seen in the regions of necrosis. A faint disulfide reaction was found in the granular debris resulting from tumor cell necrosis.

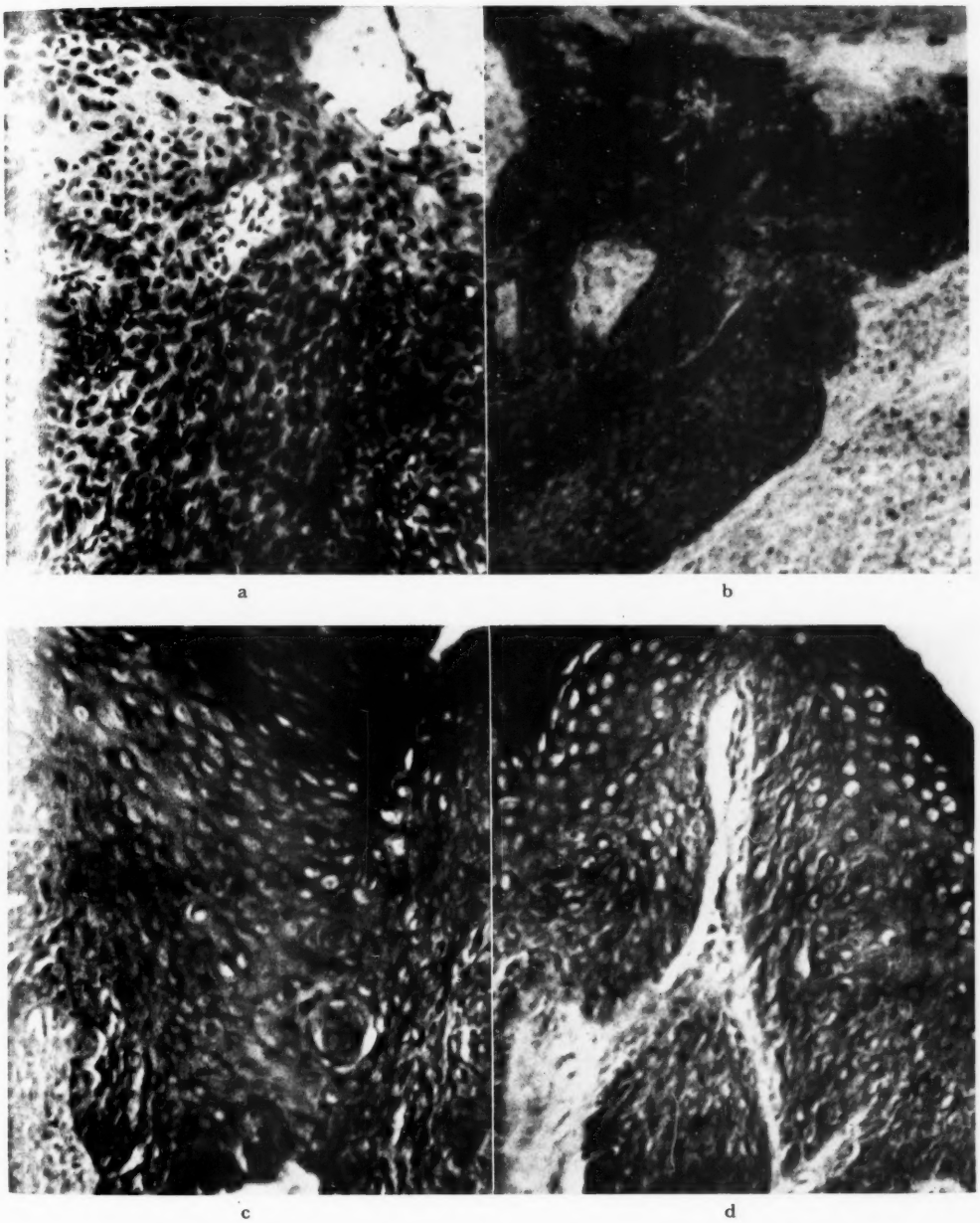
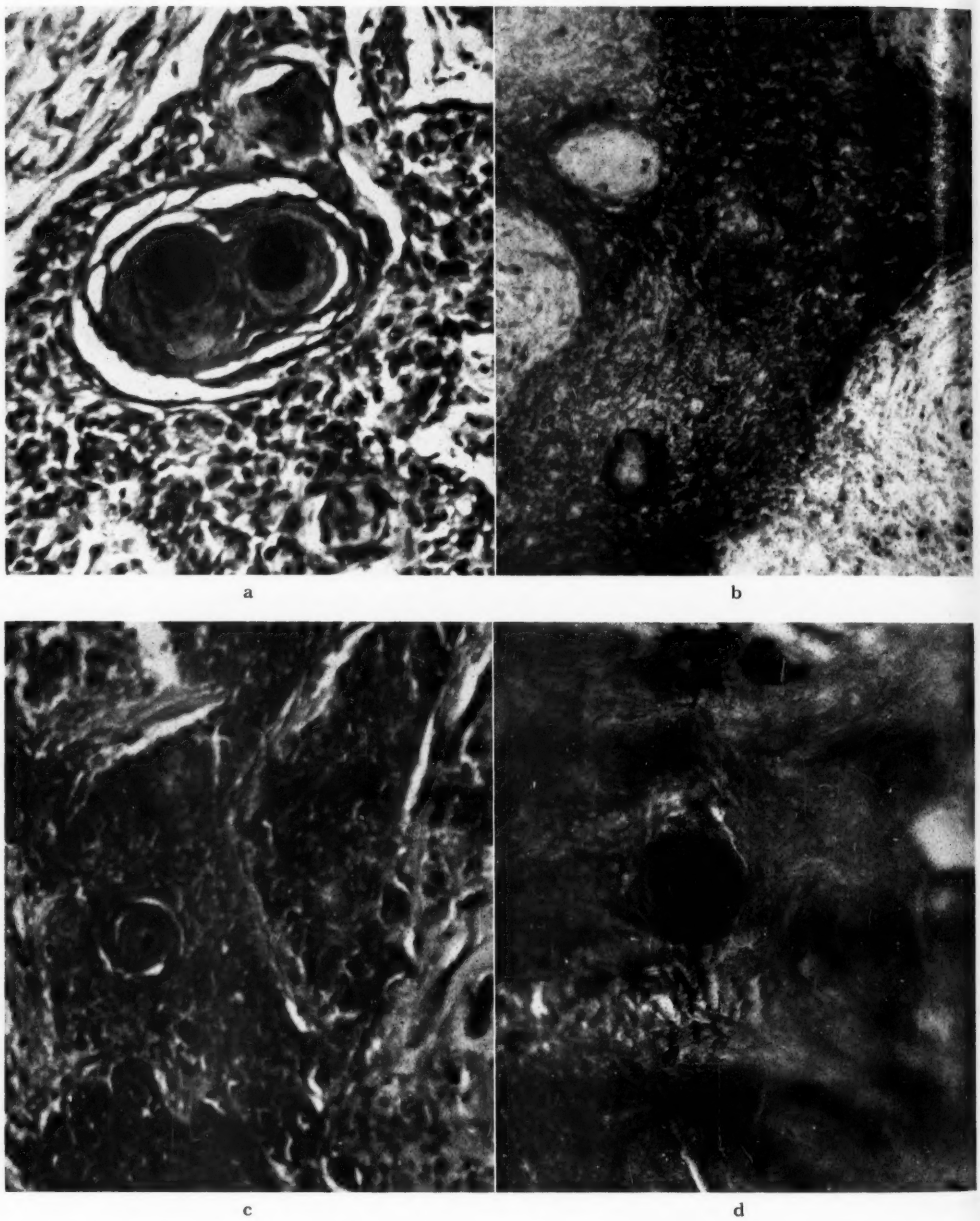


FIG. 2. Invasive squamous cell carcinoma of skin. All sections, ×115. a, Hematoxylin and eosin section. b, NT section. Heavy deposition of formazan manifesting sites of dehydrogenase activity in cytoplasm of all neoplastic cells. c, SH section. Considerable reactivity for sulfhydryl groups in cytoplasm and nucleoli of neoplastic cells. Somewhat heavier staining of superficial keratinizing cells. d, SS section. Comparatively little reactivity for disulfide groups in neoplastic cells. Intense staining of superficial keratinizing cells.



a b c d

FIG. 3. Squamous cell carcinoma of skin with much intracellular keratinization and epithelial pearl formation. All sections, ×115. a, Hematoxylin and eosin section. b, NT section. Considerable deposition of granules with sites of dehydrogenase activity in cytoplasm of tumor cells, but keratinizing cells and cells in epithelial pearls have much less evidence of dehydrogenase activity. c, SH section. Considerable reactivity for sulfhydryl groups in nucleoli and cytoplasm of tumor cells. Epithelial pearls slightly more heavily stained. d, SS section. Little reaction for disulfide groups in tumor cells. Keratinized cells in epithelial pearls are comparatively heavily stained.

DISCUSSION

Squamous carcinoma cells and normal epidermal cells showed similar histochemical reaction patterns. These apparently depended on whether the cells were viable or undergoing retrogressive changes leading to keratinization or necrosis. The reaction pattern was not altered by the cell forming part of a neoplastic process or undergoing physiologic growth and maturation.

The dehydrogenase enzymes and succinic dehydrogenase in particular, have shown correlation with sites of cell growth and function in various contexts. Sites of dehydrogenase activity occur in regions of cell growth in the human uterine cervix (10), in regions of decidual reaction in the cervix in pregnancy (8), and in sites of cell proliferation and presumed hormone production in the ovary (7). Padykula has stated that the distribution pattern of succinic dehydrogenase suggests that this oxidative enzyme is in greatest concentration within those portions of tissues and organs which show high metabolic activity. In squamous cell carcinoma of Bartholin's gland (6), evidence of dehydrogenase activity was maximal at the edge of advancing tumor masses and diminished markedly as the cells matured toward the centers of the tumor strands. This distribution pattern varied inversely with glycogen deposition in Bartholin's gland carcinoma. Glycogen deposition is an index of cell maturation in squamous epithelium of the female genital tract in much the same manner as keratinization betokens epidermal maturation. In irradiated rabbit ovaries, sites of diminished dehydrogenase activity corresponded to other evidence of cell damage (11).

The reduction of tetrazolium salts, such as used in this study for dehydrogenase localization, has shown relationship to cell growth and function in a wide variety of settings. Reduction of tetrazolium salts has been used by Jensen and co-workers as an index of the viability of plant seeds. According to Roberts, tetrazolium salts have shown reactions to regions of growth in plant tissues. These salts have also shown reactions with certain types of mammalian tumors, as demonstrated by Strauss and associates and by human tumors as shown by Black and his associates.

In experimental studies made by Barron employing protozoa (4) the sulfhydryl content of the cells increased progressively with development, reaching a maximum soon before cell division. He demonstrated that sulfhydryl groups are important in the coagulation of blood, in cell permeability, and in hormone synthesis and activity (3). Sulfhydryl containing enzymes are very sensitive to ionizing radiation being inhibited by small doses of x-radiation. The role of sulfhydryl groups in the growth of tumor tissues is said to be a corollary of the function of these groups in cell division and growth.

In general it might be said that both dehydrogenase activity and sulfhydryl groups are indices of cell metabolism and growth, but without particular specificity for squamous cell carcinoma or epidermis. Their vital roles in cell function and their apparent sensitivity to irradiation suggest that they may be in some degree indices of probable effectiveness of radiotherapy. Disulfide groups, intimately related to keratinization, appear in conjunction with maturation of squamous cells, normal or neoplastic. It is not surprising that in many respects succinic dehydrogenase and sulfhydryl groups showed similar distributions, except for actual keratinizing epithelium. Disulfide groups appeared to be an indication of maturation (keratinization) of squamous epithelium, physiologic or neoplastic.

SUMMARY

The occurrence and distribution of protein bound sulfhydryl and disulfide groups and of succinic dehydrogenase activity were studied in 38 cases of squamous cell carcinoma of skin. The results showed: (1) Sulfhydryl groups and dehydrogenase activity, both related to vital phases of cell function and growth, were found in all viable cells. (2) Evidence of dehydrogenase

activity diminished as the cells (normal and neoplastic) evidenced maturation. (3) Disulfide groups, related to cell keratinization, were found in maturing and keratinized cells, normal and neoplastic. These histochemical techniques have emphasized cell properties relating to growth, neoplasia, and possibly to radiosensitivity.

REFERENCES

1. Barrnett, R. J., and Seligman, A. M. Histochemical demonstration of protein bound sulfhydryl groups. Science, 1952, 116: 323–327.
2. Idem. Histochemical demonstration of sulfhydryl and disulfide groups of protein. J. Nat. Cancer Inst., 1954, 14: 769–803.
3. Barron, E. S. G. Thiol groups of biologic importance. Advances in Enzymology, 1951, 11: 201–266.
4. Idem. The importance of sulfhydryl groups in biology and medicine. Texas Rep. Biol. M., 1953, 11: 653–670.
5. Black, M. M., Opler, S. R., and Speer, F. D. Observations on the reduction of triphenyl tetrazolium chloride by normal and malignant human tissues. Am. J. Path., 1950, 26: 1097–1102.
6. Denham, S. W., and Foraker, A. G. Cell growth and dehydrogenase activity; a histochemical enzyme study of primary squamous cell carcinoma of Bartholin's gland. Am. J. Obst. Gyn., 1954, 67: 1151–1154.
7. Foraker, A. G., Aguilar Celi, P., and Denham, S. W. Dehydrogenase activity—I, in the ovary. Obst. Gyn., 1953, 2: 407–413.
8. Foraker, A. G., and Denham, S. W. Succinic dehydrogenase as an indicator of cellular metabolism in the cervices of pregnant and nonpregnant women. Surg. Gyn. Obst., 1953, 96: 259–264.
9. Idem. Histochemical localization of succinic dehydrogenase and endogenous reductase activity in squamous cell carcinoma of the cervix. Texas Rep. Biol. M., 1953, 11: 643–652.
10. Foraker, A. G., Denham, S. W., and Aguilar Celi, P. Localization of sites of dehydrogenase activity in the cervix uteri. Cancer, 1954, 7: 311–317.
11. Foraker, A. G., Denham, S. W., and Johnston, M. H. Histochemical changes in irradiated ovaries —I, succinic dehydrogenase activity. Arch. Path., Chic., 1953, 55: 147–153.
12. Jensen, C. O., Sacks, W., and Baldauski, F. A. The reduction of triphenyl tetrazolium chloride by dehydrogenases of corn embryos. Science, 1951, 113: 65–66.
13. Padykula, H. A. The localization of succinic dehydrogenase in tissue sections of the rat. Am. J. Anat., 1952, 91: 107–145.
14. Quastel, J. H., and Wheaton, A. H. M. Biologic oxidations in the succinic acid series. Biochem. J., Lond., 1931, 25: 117–128.
15. Roberts, L. S. A survey of tissues that reduce 2, 3, 5-triphenyl tetrazolium chloride in vascular plants. Bull. Torrey Botanical Club, 1950, 77: 372–381.
16. Rudall, K. M. Proteins of mammalian epidermis. Advance. Protein Chem., N. Y., 1952, 7: 253–290.
17. Seligman, A. M., and Rutenburg, A. M. The histochemical demonstration of succinic dehydrogenase. Science, 1951, 113: 317–320.
18. Shelton, E., and Schneider, W. C. On the usefulness of tetrazolium salts as histochemical indicators of dehydrogenase activity. Anat. Rec., 1952, 112: 61–81.
19. Strauss, F. H., Cheronis, N. D., and Strauss, E. Demonstration of reducing systems in neoplasms and living mammalian tissues by triphenyl tetrazolium chloride. Science, 1948, 108: 113–115.

COMBINED OPERATIVE PROCEDURES FOR ULCERATIVE COLITIS

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ULCERATIVE COLITIS was first described by Wilks and Moxon in 1875, but despite intensive investigation its etiology remains obscure and its response to treatment is fickle. As a consequence, approximately 20 per cent of patients with the disease either develop some complication or fail to respond to adequate medical therapy thus requiring surgical intervention to interrupt the ravages of the disease. The present article is concerned with the surgical approach to this problem and the results of treatment in a group of 24 patients over a 5 year span.

SURGICAL APPROACH

The surgical approach to this disease was at first necessarily a cautious one. The earliest operations devised for its treatment consisted of cecostomy, appendicostomy, and colostomy. All of these procedures had as their primary objective the formation of a vent through which the colon could be irrigated and the toxic material within washed away. These methods were not uniformly successful and frequently had the undesirable effect of imposing a disagreeable and offensive procedure upon an already desperately ill patient, without a beneficial result. In 1913, J. Y. Brown first proposed and employed an end ileostomy with complete diversion of the fecal stream. It became apparent, thereafter, that, though the mortality rate was high, remarkable remissions sometimes resulted, frequently with weight gains of 50 pounds or more. Furthermore, it was established that man could live without his colon, and it logically followed that the patient might be cured of his disease by removing the colon.

The conventional pattern was to perform an ileostomy as the sole initial procedure. If the patient's course was satisfactory, the colon was left intact. If, as was more often the case, his course was characterized by sepsis, failure to gain weight, and continuous rectal discharge, the colon and rectum were removed in stages. Usually, the operation was performed in three stages, but sometimes four were required to complete the ablation of the entire colon and rectum.

The mortality rate following ileostomy as the sole initial procedure was prohibitive, sometimes reaching 50 per cent and averaging around 20 per cent. However, as knowledge of protein metabolism and fluid and electrolyte balance increased, it became possible to lower this mortality rate appreciably, though it continued high. In 1949, Gavin Miller and his associates proposed ileostomy combined with right hemicolectomy as the initial procedure and demonstrated that there was actually a lower mortality than with ileostomy alone.

We believe that this principle is sound, and it is our present policy for all adult patients routinely to combine ileostomy with total colectomy or with total colectomy plus abdominoperineal proctectomy. There are a number of advantages to the combined procedure over that of ileostomy as the sole initial procedure. It lowers the mortality rate which in our series is 4 per cent when the combined procedure is used as compared with 19 per cent when ileostomy is the sole initial procedure. The combined procedure completely eliminates at least one operation and, when proctectomy is included, converts the procedure into a one stage operation. This appreciably shortens the number of hospital days compared with those required by the older staged procedures. By shortening the period of hospi-

talization, many complications such as recurrent thrombophlebitis, recurrent anemia, and homologous serum jaundice commonly associated with the multiple staged procedures are avoided. And last, it relieves both the patient and the hospital of a tremendous economic burden.

Since 1949 we have performed the combined procedure upon 24 adult patients, (Table I) with 1 death, a mortality rate of 4.1 per cent. All of the remaining patients are alive at this date, and all but 1 have returned to more or less full activity. The 1 patient who has not yet returned to full activity is still convalescing from an operation performed several months ago. There have been no late deaths.

The 1 patient died as a result of an acute leukemia, the manifestations of which did not become fully apparent until late in the postoperative period. The indication for operation in this patient was massive uncontrollable hemorrhage. A total colectomy with abdominoperineal proctectomy combined with ileostomy was performed in one stage. Some days after the operation, the patient began to bleed from her perineal wound, bladder, ileostomy, and sites of hypodermic injections; as the leukemia became more obvious bleeding from these sites increased and she expired 23 days after the operation. Permission for autopsy was not obtained. It is questionable whether the abdominoperineal proctectomy should have been undertaken in such a critically ill patient, and it is possible that she would have survived had only colectomy combined with ileostomy been performed.

In 8 of the 24 patients, a one stage procedure consisting of total colectomy, abdominoperineal proctectomy, and ileostomy was performed at 1 operation, with the 1 death mentioned. In the remaining 16 patients, the operation was total colectomy combined with ileostomy as the initial procedure; there were no deaths in this group.

It seems obvious from these results that ileostomy should be done only as a part of a larger procedure, which should include colectomy as the minimal definitive step. In some patients, a one stage procedure consisting of ablation of the entire colon and rectum combined with ileostomy is the procedure of choice. Once the decision to operate has been made, the only remaining problem is whether or not to perform proctectomy as well as colectomy. Several factors influence this decision.

It is our present policy to perform the one stage procedure upon those patients for whom operation is elective. When the indication for surgery is hemorrhage, perforation, or other acute emergency, then only colectomy with ileostomy is indicated.

When the patient is a young adult male of the elective group, it is our present policy to explain to him that while abdominoperineal proctectomy obviates the problem of carcinoma of the rectum, it is sometimes associated with impotence or subtle disturbances in sexual function which would prevent him from procreation. To date, all have chosen to leave the rectum intact and to accept the risk of developing carcinoma of the rectum rather than risk disturbance of sexual function. It remains to be seen whether any of these patients will develop rectal cancer.

The surgical problem is quite different in children under the age of puberty. In these cases ileostomy as the sole procedure is the operation of choice. Ladd and Gross report that a number of children have had intestinal continuity restored to normal following the establishment of an ileostomy for a suitable period.

INDICATIONS FOR SURGERY

The indications for surgical intervention in the presence of ulcerative colitis closely parallel those for operation upon patients with duodenal ulcer. They include perforation, massive uncontrollable hemorrhage, obstruction, and failure to respond to adequate medical therapy. In addition, however, multiple fistulas or perianal sinuses, repeated bouts of acute arthritis, and carcinoma of the colon or rectum may also be indications for operation. I have purposely

TABLE I.—COMBINED ILEOSTOMY AND COLECTOMY FOR ULCERATIVE COLITIS, 1949 to 1954

	History No.	Age, years	Operation	Date	Deaths
1	641500 G.B.	25	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	10- 1-49 3- 1-50	0
2	571365 E.F.	35	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	6- 7-50 2- 6-51	0
3	580450 D.B.	32	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	5-12-51 8-13-52	0
4	580651 M.Z. 9-20-50, Ca.	49	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	8-17-51 10-15-51	0
5	593997 J.T.	21	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	5-22-51 4- 8-52	0
6	497244 M.H.	43	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	8-31-51 2- 1-52	0
7	609063 I.M. 7-13-51	37	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	2-15-52 6-25-52	0
8	632323 F.R.	44	One stage ileostomy, colectomy, and abdominoperineal proctectomy	7-21-52	0
9	405994 G.D.	24	One stage ileostomy, colectomy, and abdominoperineal proctectomy	8- 8-52	0
10	634635 R.B.	51	One stage ileostomy, colectomy, and abdominoperineal proctectomy	9-10-52	0
11	550798 J.C.	20	One stage ileostomy, colectomy, and abdominoperineal proctectomy	9-26-52	0
12	549447 I.K.	31	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	10-31-52 11-21-52	0
13	639000 V.V.	27	Ileostomy and colectomy	11-11-52	0
14	253984 F.I.	34	One stage ileostomy, colectomy, and abdominoperineal proctectomy	11-14-52	0
15	481366 R.M.	22	One stage ileostomy, colectomy, and abdominoperineal proctectomy	2-17-53	0
16	627132 M.P.	15	One stage ileostomy, colectomy, and abdominoperineal proctectomy	4-11-53	1
17	651725 J.H.	19	One stage ileostomy, colectomy, and abdominoperineal proctectomy	4- 3-53	0
18	220733 D.N.	49	Ileostomy and colectomy	6-28-53	0
19	661596 C.Y.	27	Ileostomy and colectomy	8-10-53	0
20	593675 L.O.	26	Ileostomy and colectomy	2- 2-54	0
21	532723 B.D.	25	Ileostomy and colectomy	2-17-54	0
22	570452 J.L.	41	1. Ileostomy and colectomy 2. Abdominoperineal proctectomy	2-18-54 6-23-54	0 0
23	641972 F.B.	60	Ileostomy and colectomy	3-19-54	0
24	613638 R.C.	14	Ileostomy and colectomy	12-17-54	0

refrained from mentioning pseudopolyposis, since there is no general agreement as to whether pseudopolyposis is a forerunner of carcinoma of the rectum or not. It is, however, certain that when carcinoma of the colon or rectum develops in association with ulcerative colitis, it is fulminating in its course, and 5 year survivals are rare. In our experience at The New York Hospital, only 1 patient among 6 who had carcinoma of the colon or rectum associated with ulcerative colitis survived more than 3 years.

The primary indication for surgery in the 24 patients described was as follows: failure to respond to adequate medical therapy in 8, severe intractable hemorrhage in 5, rectovaginal fistula in 3, obstruction due to stricture in 2, perforation of the colon in 2, and sigmoid-cecal fistula, enterocolic fistula, arthritis, and carcinoma of the colon in 1 each. In addition to the primary indications for operation, many of these patients had several secondary indications as demonstrated in Table II.

TABLE II.—INDICATIONS FOR OPERATION

History No.	*Age, years*	*Indications for operation*
634635 R.B.	54	Rectovaginal fistula, fistula-in-ano
571365 E.F.	35	Failure to respond to adequate medical therapy, hemorrhage, polyposis
549447 I.K.	31	Failure to respond to adequate medical therapy, hemorrhage
580651 M.Z.	49	Carcinoma, polyposis
609063 I.M.	41	Failure to respond to adequate medical therapy, hemorrhage, fistula-in-ano, splanchnicectomy
497244 M.H.	44	Failure to respond to adequate medical therapy
405994 G.D.	24	Rectovaginal fistula, arthritis
532723 B.D.	25	Perforation of colon, multiple, with peritonitis
641500 G.B.	23	Failure to respond to adequate medical therapy, vagotomy, hemorrhage
632323 F.R.	44	Arthritis, failure to respond to adequate medical therapy
651725 J.H.	17	Hemorrhage, intractable
627132 M.P.	15	Hemorrhage, intractable
220733 D.H.	45	Hemorrhage, intractable
481366 R.M.	22	Sigmoidocecal fistula, failure to respond to adequate medical therapy
593676 L.O.	24	Enterocolic fistula, obstruction due to rectal stricture, perirectal fistula
253984 F.I.	34	Rectovaginal fistula
661596 C.Y.	27	Failure to respond to adequate medical therapy, hemorrhage
593997 J.T.	21	Anal stricture, multiple fistulas-in-ano
550798 J.C.	19	Anal stricture, multiple fistulas-in-ano
580450 D.B.	34	Hemorrhage, fistulas-in-ano
570432 J.L.	41	Severe hemorrhage
639000 V.V.	28	Failure to respond to adequate medical therapy
641972 F.B.	60	Perforation of the colon, obstruction
613638 R.C.	14	Failure to respond to adequate medical therapy

Failure to respond to adequate medical therapy was the most frequent primary indication for operation and was usually associated with several secondary considerations such as moderate or intermittent rectal hemorrhage, fistula-in-ano, arthritis, or other factors which made operation necessary. It has occasionally been stated that failure to respond to adequate medical therapy simply means that the physician has reached the end of his patience, but this group of patients was treated by a number of physicians all of whom were keenly interested in devising some method whereby the disease could be arrested without resorting to surgical procedures.

Intractable hemorrhage was the second most frequent indication for operation in this group of patients. In 10 of the 24 patients hemorrhage was a prominent symptom, and in 5 of these bleeding was controlled by multiple transfusions. In the other 5, however, hemorrhage was either so massive as to be uncontrollable by nonoperative measures or so persistent that the condition became critical. Just as gastric resection is necessary when there is uncontrollable or persistent hemorrhage from peptic ulceration, so colectomy combined with ileostomy is indicated when there is hemorrhage from ulcerative colitis. Colectomy promptly controlled bleeding in 4 of the 5 patients whose hemorrhage was the primary indication for operation. One of the 5 patients died, as mentioned previously, as the result of an underlying leukemia which became evident during the postoperative course.

Rectovaginal fistula was the primary indication for operating upon 3 patients, although there were other important secondary considerations. It is my impression that, once a rectovaginal fistula forms in the presence of ulcerative colitis, it rarely heals spontaneously. The vaginal portion of the fistula may even persist in the form of a perineal-vaginal fistula after the rectum has been removed by abdominoperineal resection, and another operation may be needed to correct this complication. Rectal stricture, presumably due to repeated inflammation and probably perirectal abscess, was the primary indication in 2 patients, both of whom also had multiple fistulas-in-ano.

Perforation of the colon was the primary indication for colectomy in 2 individuals, 1 of whom had multiple perforations with a generalized peritonitis. It is doubtful whether this patient would have survived with any other form of therapy inasmuch as she was critically ill at the time of operation with a severe peritonitis which developed while she was receiving cortisone therapy. The other

patient had a localized perforation with abscess formation. Three other patients with perforation of the colon, who were treated by simple drainage without further operation, all died. The only other surviving patient with a perforation of the colon associated with ulcerative colitis was one in whom the perforation was localized in the lower left quadrant. Ileostomy and drainage of the abscess sufficed to save this patient. It is my present belief that colectomy combined with ileostomy is the procedure of choice in patients with perforation of the colon associated with ulcerative colitis, provided the time between perforation and operation is reasonably short.

Two patients developed fistulas between loops of large bowel or between the small and large bowel, and, as would be expected, these 2 patients did poorly under conservative management and eventually required surgical ablation of the colon. As is the case with rectovaginal fistulas, internal fistulas rarely heal spontaneously in the presence of ulcerative colitis.

The primary indication in a single case was recurrent acute polyarthritis. As in cases noted by other observers, these attacks have not recurred since colectomy combined with ileostomy was performed several years ago.

The only patient with carcinoma of the colon as the primary indication for operation was a 49 year old man who was known to have had ulcerative colitis for 27 years. In this case the operation was colectomy, abdominoperineal resection of the rectum, and ileostomy in one stage. He has now survived over 4 years without evidence of recurrent carcinoma. His was the only operable case in 6 patients who had carcinoma of the colon or rectum associated with ulcerative colitis.

FOLLOW-UP

The follow-up examinations on this group of patients date back to 1949, so that in many instances sufficient time has elapsed to indicate that their present status will not be markedly affected by ulcerative colitis in the future. There have been no cases of spread of the disease into the ileum or small bowel. Eight patients, however, have required revision of their ileostomies (Table III) because of ileostomy dysfunction at the exit of the bowel through the abdominal wall, and 2 others have developed annoying prolapses of the ileostomy. Nine patients still have intact rectums which are to be removed at a suitable time.

TABLE III.—ILEOSTOMY REVISED

History No.	*Age, years*	*Ileostomy revised*
549447 I.K.	31	Prolapsed
609063 I.M.	41	Revised once
497244 M.H.	44	Revised once, fistula of ileostomy bud
405994 G.D.	24	Revised twice, stenosis of ileostomy opening
532723 B.D.	25	Revised once
220733 D.N.	45	Revised once, stenosis of ileostomy opening
661596 C.Y.	27	Revised twice: (1) fistula external to skin; (2) stenosis at skin level
550798 J.C.	19	Revised once, stenosis around ileostomy stoma, volvulus
639000 V.V.	28	Dysfunction of ileostomy, exploratory laparotomy, lysis of adhesions

All but 2 patients have improved physically so that they are able to carry on many activities which were beyond their abilities during their acute illness, and several have been rehabilitated to the extent that they can now for the first time earn a living and take care of themselves physically and economically. The 2 exceptions were the patient who died and the patient most recently operated upon. Although no woman of this particular group has borne a child, pregnancy has presented no particular problem in other women who have had ileostomy and colectomy for ulcerative colitis. Several of the men in this group have impregnated their wives and normal pregnancies have resulted.

It is not beyond the ability of some to perform heavy manual labor. One of these patients now works as a sand-hog, 1 is a cab driver, another runs a fruit stand, 1 works as a draftsman, another is a receptionist, 1 is a cashier, and another a post office employee. Several of the women have small children whom they care for with little outside assist-

ance. There seems to be little question that the majority of these patients are completely rehabilitated.

It has not been accurately determined what residual psychic disturbances are present, and it would seem profitable for someone with adequate psychiatric background to undertake such a study to determine whether major operations produce or alleviate psychic disturbances in these patients.

SUMMARY AND CONCLUSIONS

1. Ulcerative colitis is a disease of unknown etiology which responds to conservative therapy in an unpredictable manner.

2. Complications are many and varied.

3. Indications for surgery are: (a) failure to respond satisfactorily to adequate medical therapy, (b) perforation, (c) hemorrhage, (d) obstruction, (e) multiple fistulas, (f) repeated bouts of acute polyarthritis, and (g) carcinoma of the colon or rectum.

4. Ileostomy should be combined with colectomy or colectomy plus proctectomy.

5. Twenty-four patients received ileostomy combined with colectomy or colectomy plus proctectomy in one stage with 1 death—a mortality of 4.1 per cent as compared with an average 20 per cent mortality with ileostomy alone.

6. Of the 23 surviving patients, all but 1 have been rehabilitated, the exception being the 1 who was operated upon too recently to assess properly.

REFERENCES

1. Brown, J. Y. The value of complete physiological rest of the large bowel in ulcerative and obstructive lesions. Surg. Gyn. Obst., 1913, 16: 610–613.
2. Ladd, W. E., and Gross, R. E. Abdominal Surgery of Infancy and Childhood. Philadelphia: W. B. Saunders Co., 1941.
3. Miller, G. G., Ripstein, C. B., and Tabah, E. J. The surgical management of ulcerative colitis. Surg. Gyn. Obst., 1949, 88: 351–358.
4. Wilks, S., and Moxon, W. Lectures on Pathological Anatomy. 2nd ed. P. 408. London: J. A. Churchill Ltd., 1875.

EDITORIALS

PROPHYLACTIC MEASURES IN THE TREATMENT OF CANCER

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DURING THE PAST TWO OR THREE DECADES, surgeons have concentrated on the development of more extensive and more effective operations for the treatment of cancer. These efforts have been fruitful, and when added to better methods of preoperative and postoperative care, the 5 year survival rates have improved. However, during this period, certain prophylactic measures have not received adequate attention.

Years ago, it was shown experimentally that massage of tumors would shorten the life of the host animals, but the clinical significance of this finding has not been appreciated. True enough, teachers of surgery limit the number of students examining a neoplasm in a patient lest the tumor be disseminated, but another possible source of spread by trauma before the operation has not been emphasized. We refer to the soap and water preparation of the skin preceding the operation. The aseptic efficiency of soap and water preparation is unquestioned, but the danger of spread of the tumor by the scrubbing process seems real indeed. We contend that no neoplasm which could possibly be malignant should be subjected to the trauma of soap and water preparation. Probably the most important of this group are breast tumors, but any neoplasm which is palpable certainly falls into this category. Since the advent of antibiotics, the danger of postoperative infection has decreased markedly. Moreover, there are numerous skin antiseptics which when painted gently on the skin are sufficiently effective to act as substitutes for soap and water.

Elsewhere we have called attention to the danger of creation of venous emboli by operative manipulation of the tumor, and the possible implantation of malignant cells at the suture line during colonic resections for carcinoma. In relation to the former circumstance, we wish to call attention to the fact that pathologists have on numerous occasions called our attention to the presence of malignant cells in veins within the tumor. It seems logical to assume that during manipulation of the tumor incident to resection, the cells present in veins within the tumor might be dislodged, and thus migrate to the liver or lung, depending on location of the tumor. This possibility would be minimized if the vascular supply (arteries and veins) were ligated before the tumor is manipulated other than to determine its operability. It seems likely that manipulation of a tumor might also squeeze cancer cells into lymphatics, particularly since lymphatic invasion represents one of the mechanisms by which carcinoma spreads. At the operative table it is more difficult to identify lymphatic channels than blood vessels, but it is well known that lymphatics are distributed alongside blood vessels; accordingly, ligation of the vascular supply with adjacent tissue would also ligate most of the lymphatic drainage from the area being resected.

Our original report calling attention to the frequency of local recurrence at the su-

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ture line following resection of the colon dealt with a very small series of 55 consecutive cases. Since then we have enlarged the series to 140 cases. The percentage of local recurrences at the suture line which might have been caused by implantation of cancer cells was remarkably similar, being 10.9 per cent in the former series and 9.9 per cent in the latter. To prevent the possibility of local implantation we have recommended preliminary ligation of the bowel with umbilical tape several inches above and below the tumor. After the involved segment is removed, the open ends of the bowel to be anastomosed should be irrigated to remove stray cells desquamated or dislodged from the tumor. The majority of smears taken from the lumen of the bowel on the tumor side of the ligature are positive, whereas the smears taken from the lumen outside the ligature are almost universally negative. We have no proof that cells which stain well would live if transplanted into healthy tissue, but there is certainly a possibility that they would.

TEAMWORK IN THE PRACTICE OF MEDICINE

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SOME YEARS AGO I was asked to present a paper for one of the larger medical associations of this country. My title for this paper was: "The Management of Patients with Carcinoma of the Prostate." The title as it appeared in the program was "The Management of Carcinoma of the Prostate." The connotations associated with this change are symptomatic of one of the most important problems for medicine and particularly medical education today. It is particularly apropos with regard to the surgeon, since in many respects the whole future of surgery depends upon the understanding of the basic differences involved in the thought behind the above described incident.

That the medical profession is beginning to become aware of this problem is clear from the remarks made by Walter B. Martin in his President's address at the annual meeting of the American Medical Association in San Francisco in 1954. In that address he reviewed the advances of medicine over the past half century emphasizing the tremendous expansion of the quantity and quality of medical services available today. He then stated that "This very success of medicine in the material way may now threaten the soul of medicine." Medicine, he states "is something more than the cold application of science to human disease. It is a healing art and must deal with individuals, their fears, their hopes, and their sorrows." What Doctor Martin says about medicine is all too true with regard to surgery. There is no basic difference now between the surgeon and the physician. Advances in the surgical art and science have emphasized more and more the marked relationships between all fields dealing with human disease so that the surgical procedure is only an incident albeit an important one in the management of the patient with a given disease process.

Advances in the science of medicine, particularly in radiology, anesthesiology, bacteriology, and chemistry, have necessitated teamwork of the highest order in the management of the patient. These developments, in addition to economic problems in the practice of medicine, have tended to alter qualitatively the physician-patient relationships. There seems to be an uncertainty as to which member of the team is really in charge of the patient so that a patchwork of studies

may be made with no artist to bring the different parts of the mosaic to a unified whole. On the economic side there has been a tendency to classify services and simply assign values to them which are absolutely empirical and quite irrelevant of the qualities involved: the qualities of training, the qualities of art, the qualities of experience, the qualities of human understanding with regard to the particular patient who is being treated. Successes particularly in the field of public health in the management of disease processes which are fairly completely understood and the causes of which can be managed by standardized techniques have blinded us to the fact that there is still a tremendous field of medicine and surgery today in which such standardizations are impossible because of lack of information and knowledge and also because of the human factor connected with the patient himself. Thus, this very standardization of technique frequently does away with individualized care and may thus lead to inadequate medical care for the particular patient involved. The problem before medicine today from this point of view is how to maintain the advances that we have made, continue to make more of them, and at the same time prevent any tendency to ignore the individual care of the patient.

In an editorial published only a few months ago in this very journal Doctor Johnson emphasized the need for it in the postgraduate training of surgeons. It would seem that an understanding of the problem involved is necessary with emphasis throughout undergraduate and graduate medical and surgical teaching upon the patient and the responsibility of the physician to the patient. It is necessary in every case which is being studied with an undergraduate medical group, with a postgraduate group, or in actual practice that the responsibility for the management is clearly fixed upon one doctor.

The other surgeons or the physicians or scientists who are called in for aid in the study and management of the patient are consultants. Someone must make the final decision. Someone must have the responsibility. It cannot be left hanging in the air. It is the responsibility of our teachers in the medical schools and our chiefs of services in the postgraduate training areas to emphasize this aspect in medical care, both by teaching and precept. Let us in our teaching and in our practice keep up the excellent teamwork which is made necessary by our scientific advances, but at the same time realize and teach that the team must have a captain. Moreover, in the time continuum of the care of the patient the person who is captain may change just like the bombardier becomes captain of the team during the actual bombing run. That physician who is most qualified at any point in the time continuum of the care of the patient must assume command of the team. The integrations involved are complex but extremely important for the future of medicine.

BLOOD TRANSFUSION: 50 YEARS AGO AND TODAY

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ALTHOUGH THE HISTORY of blood transfusion reaches back into the middle ages, the developments occurring prior to the turn of the century are largely of academic and antiquarian interest. Only in the last 50 years have practical advancements been made in this field. In the course of a rather long life, I have been privileged to be actively engaged in this field during the last 40 years and to have employed personally the older and now antiquated techniques (vessel anastomosis, syringes).

Two completely distinct problems had to be solved before safe and relatively simple transfusions of blood became possible. The first, an immunologic problem, had to do with the study of blood compatibilities and the prevention of intravascular hemolysis. By the beginning of the century, the work of Landsteiner in blood grouping had, to a very great extent (though not completely), removed the dangers inherent in the transfusion of incompatible blood. The discovery of the Rh factor was still to wait for many years. However, the actual transference of blood from donor to recipient still had to be put on a safe and simple basis.

In the early 1900's, the only method available was direct transfusion, either by means of blood vessel suture (Carrel's technique) or the aid of a metallic cannula (Crile's method). This required a careful, difficult, painstaking, and time-consuming technique. It is no exaggeration to state that during that period, a blood transfusion was frequently a more difficult technical procedure than the operation to which it was incidental. The technical difficulties were especially great if the patient were a small child, when a difficult femoral vein-radial artery anastomosis was, at times, necessary. Another drawback was that an exact measurement of the quantity of transfused blood was impossible. Finally, two transfusions were, as a rule, the maximum that could be given to any one patient. It is, therefore, not surprising that our records at Mount Sinai Hospital show that in the early 1900's not more than 20 blood transfusions were given in a year; whereas, now, approximately the same number is performed daily.

The next practical improvement in actual blood transfusion was the introduction of the various syringe techniques. It is safe to say that almost 200 different modifications of this general method were described before its use was finally abandoned. This technique, of course, represented a tremendous advancement over the difficulties inherent in the vessel anastomosis procedure. The difficulties which were likely to be encountered in the various syringe techniques, however, were still many. All of them required a well trained and well co-ordinated team, because even a minor delay in the smooth progress of the procedure could easily result in clotting and obstruction of the needles within the donor or the recipient. As a matter of fact, this technique actually antedated the direct anastomosis methods of Carrel and Crile, having been described by Ziemssen, the great clinician of Munich, in 1894. However, as not infrequently happens, the article was lost in the literature. Another method was the use of paraffinized glass cylinders. Their chief advantage lay in the fact that the necessity for haste was not so great and the fact that the patient and donor could be in different, though not very distant, rooms. Other variations, such as the athrombit jars for col-

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lecting blood constructed by Neubauer and Lampert and Beck's apparatus, enjoyed some popularity in Germany, where they originated, but never came into extensive use.

Following this brief historical survey, we come to the discussion of the sodium citrate technique. This method is now 40 years old. Not only has it survived the test of time, but its popularity has increased with the years until, at present, it is safe to say that it is the only method of blood transfusion used on any extensive scale.

The anticoagulant properties of sodium citrate in vitro had been known for years but before it could be used for blood transfusion purposes, certain pharmacologic questions had to be answered by careful animal experiments. As a result of these studies, it was established that the minimum concentration of sodium citrate which would prevent blood coagulation during its transference to the patient from donor was 0.2 to 0.3 per cent. Furthermore, it was demonstrated that a dose of 5 grams could be safely introduced into the recipient even when given by the rapid method employed in the early years of citrate transfusion. At present, when blood is administered in much greater quantities, but at a slower rate, it has become evident that considerably larger quantities of sodium citrate may be injected without danger, since this chemical is excreted very rapidly. In addition, it was shown that the introduction of this anticoagulant did not result in any degree of inhibition of the coagulation of the blood of the recipient. Paradoxically, a transient shortening of the coagulation time, with a rapid return to normal, has been noted.

The results of these experiments were reported by me (12) in January 1915. In the same month, Agote in Buenos Aires reported a case in which he had successfully used the same dose of sodium citrate. Unknown to either of us, Hustin in Brussels had previously used in 1 patient a small amount of citrated blood (150 c.c.) equally diluted with a glucose solution. Hustin's work came to nothing because he assumed that it was necessary to mix the citrated blood with equal parts of glucose solution, so that the blood was greatly diluted (as Keynes reported).

Though it took many years before blood banks were actually organized, the basic requirement—a method permitting the collection, storage, and transportation of fluid blood—had already been met in the first report of citrate transfusion in

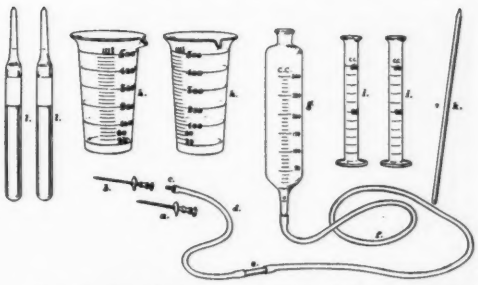

FIG. 1. Complete outfit for transfusion of citrated blood, author's technique, 1915. Originally 50 cubic centimeters of a 2 per cent solution were used for 450 cubic centimeters of blood.

1915. As a matter of fact, by 1916, the late Doctor Brem had already collected citrated blood in his office and taken it by plane to a patient in another city. Such episodic attempts were soon forgotten. Twenty more years elapsed before Judin in 1933 and Fantus in 1937 organized blood banks as we now know them. The blood used by the Russian, Judin, was derived from cadavers, a method which could not have achieved popularity in our country. Fantus in Chicago was actually the first to establish a blood bank based on living donors and, in the conduct of which, the citrate method was indispensable. It is a sad commentary that the modern and extensive organization of blood banks had to wait until the requirements of World War II made

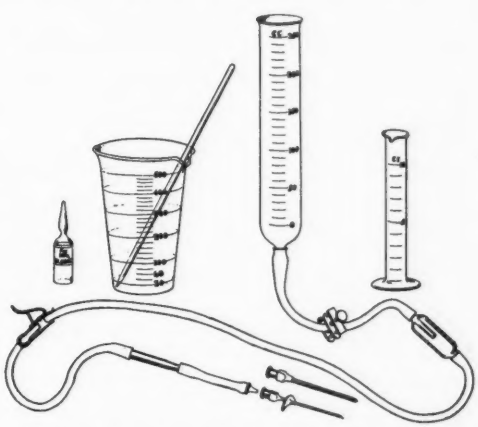

FIG. 2. In later years 5 cubic centimeters of a 30 per cent solution of sodium citrate were mixed with 500 cubic centimeters of blood. The glass dropper was added about 1925.

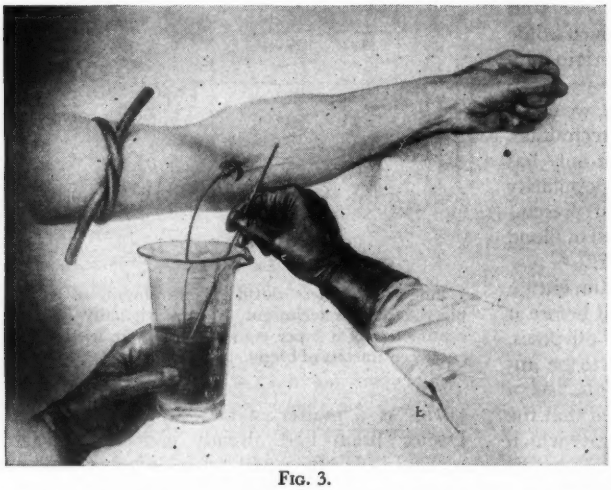

FIG. 3.

FIG. 3. Taking blood from the donor. A rubber tube leading from the cannula to the bottom of the glass jar is not shown. The use of sterile gowns and sterile gloves for doctors and nurses is essential in order to insure complete asepsis.

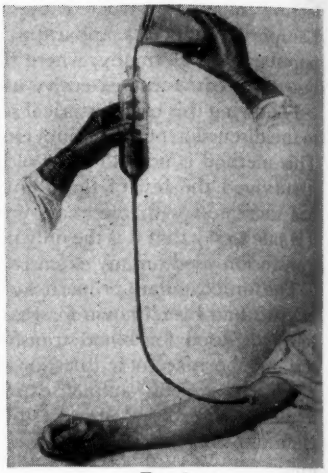

FIG. 4.

FIG. 4. Infusion of citrated blood into the recipient.

the transportation and use of stored blood imperative.

It is interesting to note that until the successful development of blood banks, the use of citrated blood for transfusion purposes was not universally accepted. Even in our own hospital there were two camps, almost equally divided, as to the desirability of its use. In the literature, frequent claims appeared that citration of blood injured or even destroyed red and white cells, as well as platelets. Following the successful implementation of blood banks, these objections were suddenly stilled and, at present, citrated blood is used practically universally.

For some time, it was also alleged that the increased frequency of posttransfusion chills was due to the presence of sodium citrate in the blood. This contention was definitely and finally refuted in 1933 by Rosenthal, at that time hematologist at the Mount Sinai Hospital. By introducing and enforcing stricter regulations concerning the cleansing of all glassware, tubing, needles, and cannulas used in blood transfusions, he was able to reduce the incidence of postcitrate transfusion chills from 12 to 1 per cent. Satunov (Russia) reported a reduction of from 53 to 2 per cent of posttransfusion chills, following the introduction of the Mount Sinai technique in his institution.

Today, the problem of reactions due to nonspecific pyrogens has been settled simply by never reusing any of the sets delivered by the manufacturer for transfusion purposes. Our sets, consisting of glassware, cannulas, and tubing, come to us sterilized by one of the commercial houses. They are well organized for mass sterilization. After the transfusion the complete set is discarded. Neither glassware, nor cannulas, nor tubing are used again for blood transfusion—an apparent waste, but in the long run the best protection for the patient.

The number of these sets used yearly in the United States staggers the imagination. During the recent Korean War, approximately 10,000,000 sets were manufactured annually to supply both the needs of the Armed Forces and the civilian population. It is safe to assume that even in peace times half that number is used in this country.

The bottles, as they are delivered from the manufacturers, contain sodium citrate solution mixed with dextrose and citric acid. They are in use at Mount Sinai Hospital today. Dextrose solution was added because of the demonstration by Rous and Turner that when it is mixed with the citrate solution, it lengthens the life of the red blood corpuscles. However, it is interesting to note that at the University of Chicago, Allen

has discarded the anticoagulant acid citrate dextrose solution and uses pure sodium citrate only, exactly as originally suggested by us 40 years ago.

I am still today strongly in favor of the open method as described by us in 1915 when certain precautions just presented are observed. A metal cap used for bank blood bottles which is easily removable under sterile precautions will not interfere with the aseptic technique. If we can perform major operations (just to mention brain tumors, chest, and abdominal operations, often lasting many hours) without danger of infection, it seems clear that the advantages of a closed method over the open method have been unnecessarily overemphasized.

Prior to the establishment of blood banks, the procurement of properly typed individual donors presented certain difficulties, especially if large quantities became necessary during an operative procedure. The possibility of storing blood already typed made it possible to obtain desired blood in almost any necessary quantity and made a transfusion no more difficult than the administration of saline intravenously. It also made it feasible to give very large quantities of blood when such indications arose. For instance, not infrequently during a prolonged operation or during a long illness patients receive as much as 15 quarts of blood. As was perhaps to be expected, such ease in securing blood was apparently followed by a certain laxity in the indications for transfusion. However, in our institution during the last few years, due to stricter regulations, the number of transfusions seemed to have reached a stationary level.

The activities of the American Red Cross have contributed greatly to the widespread storage and use of blood in this country. During one fiscal year (1952 to 1953) 4,121,000 pints of citrated blood were collected by this agency alone for defense and for vital civilian need. New York alone provided 218,603 pints. Approximately one-half of the blood dispensed in our hospital is received from the Red Cross. The other half is supplied by voluntary donors or is bought from commercial blood centers.

Forty years have elapsed since I presented the simple technique of collection and transfusion of citrated blood (Figs. 1, 3, and 4). However, even today no unanimity exists about certain points of technique. One of the controversial points is the use of the so-called closed or open method for

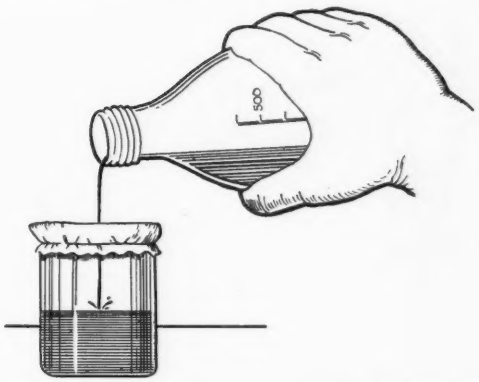

FIG. 5. Blood is poured from the vacoliter bottle into a glass beaker, covered with gauze, thus separating the fluid blood from its coagula (combined closed and open method).

collection of the blood and its injection into the patient. In our original apparatus (Fig. 1), we used a wide open, graduated, glass beaker with a sodium citrate solution at the bottom, the donor's blood being collected by gravity. I still have the first sodium citrate solution made for me by a local pharmacy (Van Horn and Sawtell) in 1915 and a 50 cubic centimeter ampule prepared by a nationally known pharmaceutical manufacturer. After all these years they show no sign of deterioration.

In the beginning, we used 50 cubic centimeters of a 2 per cent citrate solution for 450 cubic centimeters of blood. Subsequently, we used 5 cubic centimeters of a 30 per cent solution, as suggested by Agote (Fig. 2), thus reducing the dilution of the blood. Today, the sets which are supplied by commercial houses, and which are in wide use all over the United States, are delivered to the hospitals containing 50 cubic centimeters of sterile anticoagulant acid citrate dextrose solution. When the blood bank was introduced at Mount Sinai Hospital in 1938, the open glass beaker was replaced by a Mason jar with a metal cover in which the blood was kept in the blood bank. Immediately before its use, the metal cover was removed and the blood was filtered through a few layers of sterile gauze (Fig. 5) into an open glass beaker and then poured into a sterile flask which led to the patient's vein (Fig. 6). The flask was then covered with a parchment cover (Fig. 7). The fact that many tiny coagula were frequently noted on the

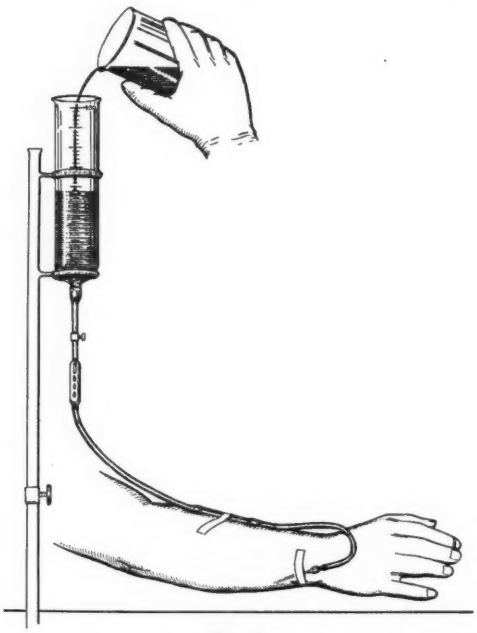

FIG. 6.

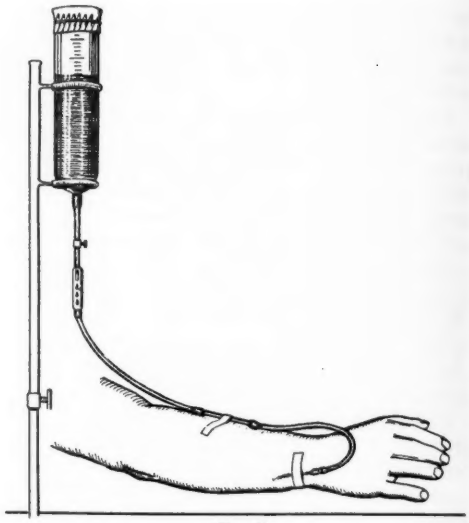

FIG. 7.

FIG. 6. The blood is poured into the flask.
FIG. 7. A parchment cover is put on top of the flask.

gauze filter was the best proof that this step served a useful purpose. It should be borne in mind that the original citrate technique was devised for transfer of citrated blood from donor to recipient within an hour.

This technique was used with excellent results at our hospital for many years (1938 to 1944). After the preparation of sterile blood transfusion sets was placed in the hands of commercial houses, the open method was replaced by the so-called closed method. The qualification "so-called" is used because the air vent (Fig. 8), which is absolutely necessary for the free flow of blood, makes the term a misnomer. With this method, the blood is not filtered before it reaches the tube. In order to prevent clots from entering the circulatory system of the recipient, a plastic filter with fine openings is located between the bottle and the tube. This fine filter is at times blocked by small clots, thus preventing the free flow of blood from the bottle to the patient and frequently making the use of a large air vent (Fig. 9) necessary.

Table I shows the increase of the number of blood transfusions at Mount Sinai Hospital over a period of 30 years.

As at present distributed by the commercial houses, vacuum bottles containing the anticoagulant acid citrate dextrose solution are used for collecting the blood. It is a question as to whether the aspiration of blood into a vacuum bottle does not mechanically injure vital morphologic elements of the blood, and whether the gravity method is not preferable.

We need not dwell upon the importance of strict asepsis to be maintained during a transfusion.

Up to the introduction of the citrate method any transfer of blood over any distance was impossible on account of the danger of clotting of the collected blood. This picture changed completely when the blood was mixed with sodium citrate which made transport of blood from any part of the world to any other points on the globe possible. For instance, during World War II 1,000 pints of group O blood were flown daily across the Atlantic ready for immediate use, without any further cross-matching of the blood.

A new and increasingly important problem has appeared in the use of blood transfusions. I have reference to the danger of homologous serum jaundice (virus hepatitis). This was first

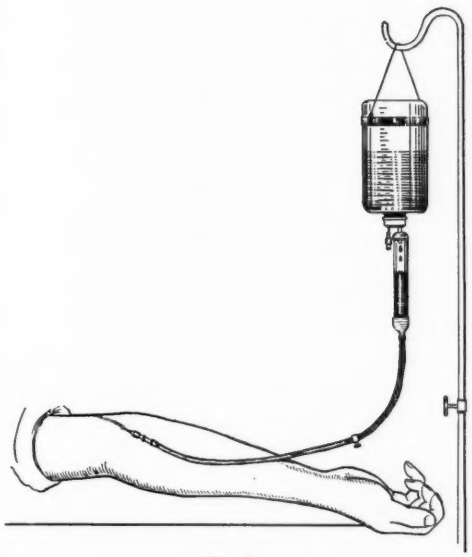

FIG. 8.

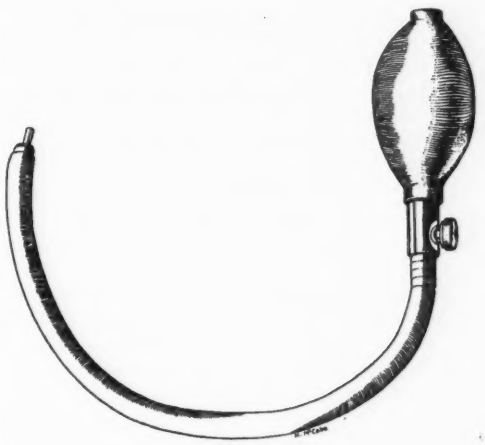

FIG. 9.

FIG. 8. Air vent used in so-called closed method.
FIG. 9. Large air vent.

noticed on any scale during the extensive use of pooled plasma during World War II. It has now been emphasized that it also occurs following blood transfusions. The incidence following the use of pooled plasma will probably always be greater than individual blood transfusions, because of the danger of pooling such infected blood into one large unit. Different methods of eliminating the viral content of blood and plasma have so far not proved entirely successful. Lately, however, Garrott Allen and his group have presented a possible solution of this problem. Instead of lyophilizing, freezing, or refrigerating the plasma for preservation, it is stored for 6 months at room temperature under aseptic precautions. In a recent personal communication, Allen states that he has not observed a case of homologous serum jaundice in any patient receiving pooled plasma (kept at room temperature for at least 6 months). In addition, he cites the experience of others (approximately 145 blood banks in this country and abroad). Altogether, more than 300,000 units of liquid plasma have been dispensed without encountering any incidence of homologous serum jaundice.

While the method of Allen shows a remarkable reduction in viral hepatitis following the administration of stored liquid plasma, such a technique cannot be applied to blood transfusions. Our present anticoagulant acid citrate dextrose mixtures only permit the use of red cells up to 3 to 4 weeks.

In my last paper (13) I quoted the following figures for homologous serum jaundice following blood or plasma transfusions: blood transfusions, 0.5 per cent; plasma transfusions, 3 per cent. Allen's recent figures are: blood transfusions, 0.106 per cent; plasma transfusions, none.

There is no fundamental difference between Allen's technique for the storage of blood from the method in general use. For this reason the slight difference in the incidence of homologous serum jaundice following blood transfusion (0.5 as to 0.1 per cent) may not be found if a larger series of cases were studied. However, the figures

TABLE I.—INCREASE IN THE NUMBER OF BLOOD TRANSFUSIONS OVER A PERIOD OF 30 YEARS AT MOUNT SINAI HOSPITAL, NEW YORK

Year	*No. of transfusions*	*No. of beds*
1923	143	669
1932	477	728
1935	794	785
1938	Blood bank started	785
1941	2,097	785
1952*	2,874	804
1953*	3,179	978

*The figures for 1952 and 1953 indicate the number of individual patients who received blood transfusions. Naturally, many patients were given a number of blood transfusions (sometimes up to 10 or even more) during their stay in the hospital.

for virus hepatitis following plasma transfusion (3 per cent to none) are most impressive and undoubtedly due to Allen's new method of plasma preservation. At Mount Sinai Hospital plasma is administered very rarely.

Even if the incidence of homologous serum jaundice following administration of plasma should be largely eliminated, it will still not replace actual transfusion of whole blood. As Ravdin recently stated, "there is no substitute for blood."

During the last few years a number of papers have been published recommending intra-arterial blood transfusion in cases of deep shock. The authors seem to be under the erroneous impression that this method is of fairly recent date. However intra-arterial blood transfusion preceded even the direct anastomosis method of Carrel and Crile by about 30 years. The first paper recommending intra-arterial blood transfusion as a new method appeared over 80 years ago. In 1871 Hueter reported 8 cases in which defibrinated blood was injected by this route.

In my opinion intra-arterial blood transfusion should never be used. It is a dangerous therapeutic weapon. A number of cases of complete gangrene of the hand have been reported which required amputation.

I hope I have succeeded in presenting to you how thoroughly and markedly the introduction of the citrate technique has simplified the transfusion of blood. Due to this simplification and due to the organization of blood banks which it made possible, innumerable lives have been saved in our country, as well as on the battle fields of Europe and Asia. Serious operations never before attempted have been performed successfully since the introduction of the citrate method. One can say without exaggeration that the citrate method of blood transfusion presented an important contribution to the welfare of humanity.

SUMMARY

A brief review of the techniques (vessel-anastomosis, syringe methods, etc.) which antedated the citrate method is presented. Results of experiments which fixed the proper minimal and maximal doses of sodium citrate in blood transfusion are reported. The apparatus used in our first transfusions in January 1915 is shown. The introduction of the blood bank by Judin and Fantus popularized blood transfusion. A table showing the increase in the number of transfusions at Mount Sinai Hospital is presented. Comparison of the open and the so-called closed method of blood transfusion is made. The importance of strict aseptic precautions in the administration of blood is stressed.

REFERENCES

1. Agote, L. Nuevo procidimiento para le transfusion del sangre. An. Inst. clin. méd., B. Air., 1915, Jan.
2. Allen, J. G., Enerson, D. M., Barron, E. S., and Sykes, C. Pooled plasma with little or no risk of homologous serum jaundice. J. Am. M. Ass., 1954, 154: 103.
3. Beck, A. Ueber Bluttransfusion. Münch. med. Wschr., 1925, 41: 349.
4. Brem, W. V. Blood transfusion with special reference to blood test. J. Am. M. Ass., 1916, 67: 190.
5. Carrel, A. La technique opérative des anastomoses vasculaires. Lyon Méd., 1902, 98: 859.
6. Crile, G. Technic of direct transfusion of blood. Ann. Surg., 46: 329.
7. Fantus, B. The therapy of Cook County Hospital; blood preservation. J. Am. M. Ass., 1937, 109: 128.
8. Hueter, C. Die intra-arterielle Bluttransfusion. Arch. klin. Chir., 1871, 12: 1.
9. Hustin, A. Note sur une nouvelle méthode de transfusion. Bull. Soc. sc. méd. natur. Bruxelles, 1914, 72: 104.
10. Judin, S. La transfusion du sang de cadavre à l'homme. Paris: Masson & Co., 1933.
11. Keynes, G. Blood Transfusion. P. 37. Baltimore: Williams & Wilkins Co., 1949.
12. Lewisohn, R. A new and greatly simplified method of blood transfusion. Med. Rec., N. Y., 1915, 87: 141.
13. Idem. The romance of the modern era of blood transfusion. J. Mount Sinai Hosp. N. York, 1951, 17: 393.
14. Lewisohn, R., and Rosenthal, N. Prevention of chills following transfusion of citrated blood. J. Am. M. Ass., 1933, 100: 466.
15. Neubauer, O., and Lampert, H. Ein neuer Bluttransfusions-apparat. Münch. med. Wschr., 1930, 77: 582.
16. Ravdin, I. S. Plasma expanders. J. Am. M. Ass., 1952, 150: 10.
17. Rous, P., and Turner, J. R. The preservation of living red blood cells in vitro. J. Exp. M., 1916, 23: 219.
18. Satunov. Blood transfusion. Vest. Khir., 1934, 101.
19. Ziemssen, H. Ueber Transfusion. Münch. med. Wschr., 1894, 41: 349.

The Book Shelf

A SURGICAL PHILOSOPHER'S CREDO: EXCERPTS FROM THE WRITINGS OF WILLIAM STEWART HALSTED

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Conceptions from the past blind us to facts which almost slap us in the face. —*W. S. H.*

In 1919 John Chalmers Da Costa, Professor of Surgery at Jefferson Medical College, Philadelphia, dedicated the eighth edition of his *Modern Surgery* with a remarkable and arresting eulogy:

This book is dedicated to the chief surgeon and inspiration of one of the greatest, most progressive and most influential surgical clinics in the world, a clinic from which come important facts, real ideas, and brilliant men.

To the Operator, the Teacher, the Investigator, and the *Surgical Philosopher:*
Dr. William Stewart Halsted,
The distinguished Professor of Surgery
in Johns Hopkins University.

Dr. Halsted is credited properly with having founded a school of surgery based upon the now universally accepted concepts of careful and complete hemostasis, absolute asepsis, gentle handling of tissues, and accurate reapproximation of divided tissues. To these concepts should be added his scholarly approach to every patient who came under his care, his thoughtful consideration of every aspect of the surgical disorder before him. Time passed unnoticed as he studiously mulled over in his mind the best possible attack upon the particular problem in hand. Experiments would be conducted in the laboratory, testing new ideas on animals, while the patient resignedly awaited his operation. Annoyance at these delays was freely expressed by some of his resident surgeons. Harvey Cushing, in particular, chafed at delay, and was known in his youthful enthusiasm to have brazenly shielded patients from the Professor's careful scrutiny.

The extent of Professor Halsted's influence on American surgery was convincingly demonstrated by Noland Carter's tabulation of surgeons who had been trained either by himself or by his expertly trained resident surgeons. This extraordinary list includes 37 professors of surgery or of its divisions, 14 clinical professors, 18 associate professors, 14 associate clinical professors, 17 assistant professors, 16 assistant clinical professors, 23 instructors, and 99 private practitioners in surgery. It is doubtful if any one man in medicine or surgery has ever influenced a greater number of teachers and disciples and through them an additional vast host of medical students.

The philosophy underlying his surgical concepts may perhaps be best portrayed by selected excerpts from his writings. These present briefly the thoughts and practices which emanated from the mind of this illustrious surgeon, whose stature increases rather than diminishes as the years roll by. The world owes much to the inspiring example of this bold though careful operator, this thoughtful and original surgeon, this learned and scholarly scientist.

The surgeon's method of dealing with the blood vessels is a criterion of his proficience in his art. . . . The moment of tying the ligature is indeed a dramatic one. The monstrous, booming tumor is stilled by a tiny thread, the tempest silenced by the magic wand.
—*Ligation of the Left Subclavian Artery*, 1921

One of the chief fascinations of surgery is the management of wounded vessels, the avoidance of hemorrhage. The only weapon with which the unconscious patient can immediately retaliate upon the incompetent surgeon is hemorrhage. If he bleeds to death, it may be presumed that the surgeon is to blame, whereas if he dies of infection, or shock, or from an unphysiological operative performance, the surgeon's incompetence may not be so evident.
—*Ligation of Common Iliac Artery*, 1912

The value of the artery clamps is not likely to be overestimated. They determine methods and effect results impossible without them. They tranquilize the operator. In a wound that is perfectly dry, and in tissues never permitted to become even stained by blood, the operator unperturbed, may work for hours without fatigue. The confidence gradually acquired from masterfulness in controlling hemorrhage gives to the surgeon the calm which is so essential for clear thinking and orderly procedure at the operating table. —*The Operative Story of Goitre*, 1920

From 1880 to 1886, the period of my surgical activities in New York, I neither saw nor heard of an operation for goitre except that in one instance I assisted Dr. Henry B. Sands to extirpate a small tumor from the right lobe of the thyroid gland. The patient, a male was operated upon in the sitting posture, with a rubber bag to catch the blood tied about his neck. We had only two artery forceps, all, probably, that the hospital afforded, and these were of the mouse-toothed or bulldog variety (Liston's).
—*The Operative Story of Goitre*, 1920

Rarely had I seen in our country, prior to my first visit to Europe (1879), more than one artery clamp at a time left hanging in a wound. Clamps were too few for this—four to three or even two being considered ample for an operation. Few hospitals, in New York at least, possessed as many as six artery clamps in 1880. I recall vividly an operation in Vienna performed by Mikulicz in 1879 in Billroth's clinic. Americans, newly arrived in Austria, we were greatly amused at seeing perhaps a dozen clamps (Schieber) left hanging in a wound of the neck while the operator proceeded with his dissection, and were inclined to ridicule the method as being untidy or uncouth. Slowly it dawned upon us that we in America were novices in the art as well as the science of surgery.
—*The Operative Story of Goitre*, 1920

Until about 1890 the tenaculum was a favorite instrument in America for checking hemorrhage, especially with some of the senior surgeons, and until about 1880 was quite universally employed here, its only rivals being the inadequate mouse-toothed, spring forceps and the Péan or Koeberlé clamps. Then almost simultaneously came the clamps of Spencer Wells and (1879) of the writer, of which the Péan-Koeberlé clamp was the prototype. The point of my clamp was snub-nosed originally, but the length and spread of the handles, the essentially new features, were the same as at present. With the development of the transfixion method with milliner's needles and the use of the fine black silk, the nose of the clamp was made finer (1889). Two or three years later it assumed its present form.
—*The Operative Story of Goitre*, 1920

We have made many experiments on the disinfection of the hands. On several occasions forty-five minutes were devoted to the disinfection of one pair of hands and without success. If it were possible to sterilize the hands of the operator and his assistants and the skin of the patient, the surgical technique might be made a practically perfect one. The danger of infection from the air is probably a theoretical and not a real danger. —*The Treatment of Wounds*, 1890

Since every one, including the operator, has invariably worn rubber gloves, suppuration, even in the operations for hernia, has occurred in probably less than 1 per cent of the cases. In 1890, all the assistants at an operation, the nurses and physicians, systematically wore gloves, but the operator wore them only for special operations, such as exploratory laparotomies, explorations for foreign bodies, loose cartilages in the joints, suture of the fractured patella, etc. —*Radical Cure of Hernia*, 1903

Greater advance was made in the operative treatment of goitre in the decade from 1873 to 1883 than in all the foregone years—I may say, than in all the years that have followed. Unquestionably this rapid progress was due chiefly to the possibilities and the impetus given by the introduction of antiseptic surgery. Germany, Austria and Switzerland were the countries whose surgeons accepted promptly the doctrines of Lister. It was the German surgeons, notably Von Bruns, Bergmann, Schede, Kümmell, Neuber and Schimmelbusch, who did most to eliminate the unessential features of Listerism and to replace antisepsis with asepsis.
—*The Operative Story of Goitre*, 1920

I believe that the obstruction to the circulation produced by sutures and ligatures is often the immediate cause of suppuration in infected wounds, and that the larger the masses of tissue constricted and the tighter the strangulation the greater the danger of suppuration. The complete strangulation of large masses of tissue we try to avoid by using very weak silk for the sutures and ligatures.

The occasional breaking of the silk reminds one that he is trying with too much force or that he has included too much tissue in his ligature.
—*The Treatment of Wounds*, 1890

The following experiments were designed by Dr. Halsted to show that tissues, notably the peritoneum, can in the absence of a foreign

body or strangulated tissue, tolerate a massive dose of bacteria, whereas the presence of devitalized tissue provides a culture medium upon which bacteria will multiply to produce infection:

One cubic centimeter of a bouillon culture of Staphylococcus aureus (Culture #2) was introduced into the peritoneal cavity of 10 dogs. Peritonitis did not develop in a single case.

A small piece of sterilized potato was introduced into the peritoneal cavity of 5 dogs. Peritonitis did not develop in a single case.

A small piece of potato covered with a thick growth of Staphylococcus aureus (Culture #2) was introduced into the peritoneal cavity of 7 dogs. All the dogs died of general peritonitis.

In eight dogs a small piece of omentum was ligated with a strong silk. The ligature and the tied off portion of the omentum were inoculated with a drop or two of a bouillon culture of Staphylococcus aureus. There was fatal peritonitis in two cases, and circumscribed peritonitis in two cases. Four of the dogs recovered without peritonitis.—*The Treatment of Wounds*, 1890

The surgeon who has become convinced of the importance of devitalizing tissues as little as possible will not only employ the finest adequate silk, but will, as he ties, note the force necessary to check the hemorrhage, and use no more. By practice the operator acquires a delicacy in tying, and develops a particular sense which enables him to gauge with accuracy the amount of pull which, for example, a thread #00 will permit.—*Operative Story of Goitre*, 1920

Tissues included between two ligatures are more or less tense according to the distance between the latter; on being divided these tissues become lax and thus loosen the hold of the ligature. To prevent slipping of the ligature under these circumstances, force sufficient to crush the enclosed tissues would have to be exercised; the greater the force the greater must be the strength of the ligature. Is it not a more rational procedure to transfix some part of the tissues to be ligated and use a fine thread for the ligature which, thanks to the transfixion, may be tied with just force enough to stop the flow of blood?

—*The Operative Story of Goitre*, 1920

I believe that the tendency will always be in the direction of exercising greater care and refinement in operating, and that the surgeon will develop increasingly a respect for tissues, a sense which recoils from inflicting unnecessary insult to structures concerned in the process of repair.... Healing is menaced when the circulation of the tissues to be united is impaired. —*The Employment of Fine Silk*, 1913

With the finest silk and needles one can perform feats in hemostasis which would be very difficult or impossible with catgut; for example, the control of small bleeding points over the trachea, of the pia mater, of the periosteum, and the suture of wounds of vessels.

Now that rubber gloves are invariably worn, the results with silk, properly employed, are so perfect that I believe its adoption will ultimately become general. —*The Employment of Fine Silk*, 1913

Away with the catgut!

To what misfortunes catgut can give rise more than one communication in the medical journals of years ago has testified. Kocher relates the disastrous experience he had with catgut from May to July, 1887. Of 31 operations performed in a period of 7 weeks, serious infection of the wound occurred in 29.

—*Surgical Technique*, 1913

This afternoon, having occasion to have the left first upper incisor tooth filled and finding that the dentine was extremely sensitive, I induced Dr. Nash, to try the effects of cocaine. The needle was passed through the mucous membrane of the mouth, to a point as close as possible to the infra-orbital foramen, and 8 minims were injected. In two minutes there was complete anesthesia of the left half of the upper lip and of the cheek somewhat beyond the angle of the mouth. —*Conduction Anesthesia*, 1884

Since the foregoing was written we have made some additional experiments which seem of interest. Dr. Halsted gave Mr. Locke, a medical student, an injection of 9 minims, trying to reach with the point of the needle the inferior dental nerve where it enters the dental canal. In from 4 to 6 minutes there was complete anesthesia of the tongue.

This evening Dr. Halsted gave me an injection of 17 minims, the needle being introduced along the internal surface of the left ramus until it touched the inferior dental nerve, causing a sharp twinge along the whole line of the lower teeth. In 3 minutes, there was numbness and tingling of the skin, extending from the angle of the mouth to the median line, and also of the left border of the tongue. In 6 minutes there was complete anesthesia of the left half of the lower lip. —*R. J. Hall, M.D.*, Dec. 1, 1884

One of the major operations performed by me under cocaine anesthesia during the winter of 1884–1885 was the freeing of the cords and nerves of the brachial plexus after injection of the roots of this plexus. This operation was performed in a large tent which I built on the grounds of Bellevue Hospital, having found it impossible to carry out antiseptic precautions in the general amphitheater of Bellevue Hospital where the numerous anti-Lister surgeons dominated and predominated.

—*W. S. H. to R. Matas*, May 30, 1921

I dislike to have my operation referred to as a modification of Bassini's operation. The operations are undoubtedly original with both of us, and mine was described several months before we had heard of Bassini's operation. You may know that in my operation the cord which is transplanted out into the thicker muscle lies superficial to the aponeurosis of the external oblique muscle, and not, as in Bassini's operation, in a fold of and under this aponeurosis.

—*The Operative Treatment of Hernia*, 1895

I have never made use of the rectus muscle in operating for the cure of inguinal hernia, believing that it would not remain in its abnormal position. The idea of rectus transplantation originated independently with both Bloodgood and Wölfler. The use of the sheath of the rectus was first employed by Berger of Paris and by me. I knew nothing of Berger's description of this method when I devised it, almost simultaneously. In the indirect cases where there is the least tension of the stitch binding the internal oblique muscle to Poupart's ligament, I make a vertical relaxation cut in the anterior sheath of the rectus. You will be interested to observe the wide triangular opening which follows this cut when there is tension of the said suture.—*W. S. Halsted to William C. Lusk*, April 14, 1913

The percentage of recurrence after operations for the direct variety of hernia is, as you know, very great. In most clinics it is probably over twenty-five per cent. In our clinic, it is at least as high as ten per cent, and probably much higher, but thus far I have found no case of recurrence in which the anterior sheath of the rectus muscle has been employed to cover the defect. Perhaps the difference in result is not altogether owing to the fact that the sheath of the rectus is made use of in the manner described. Some of the success is probably to be attributed to the care of those operators who have realized the danger of recurrence and hence have been solicitous to avoid it by the careful employment of all the devices at their disposal. One or two of my best house surgeons had the impression that almost any operation would cure a hernia and the percentage of recurrences in the cases operated upon by men holding these views has been particularly large.—*W. S. Halsted to William C. Lusk*, April 29, 1913

We have operated one hundred and sixty-five times for the cure of various forms of hernia in both sexes without a death from the operation. One hundred and six males with inguinal hernia have been operated upon by my method. The wounds, with few exceptions, have healed absolutely per primam. Thus far we have been unable to find a single recurrence in cases whose wounds healed per primam.

—*Radical Cure of Hernia*, 1895

The pectoralis major muscle, entire or all except its clavicular portion, should be excised in every case of cancer of the breast, because the operator is enabled thereby to remove in one piece all of the suspected tissues.

The suspected tissues should be removed in one piece (1) lest the wound become infected by the division of tissues invaded by the disease, or of lymphatic vessels containing cancer cells, and (2) because shreds or pieces of cancerous tissue might readily be overlooked in a piecemeal extirpation.

—*Cancer of the Breast*, 1894

Volkmann (Sprengel) and Gussenbauer were perhaps the first to suggest that it might be well to explore the axilla in every case, but Küster was the first to advocate the systematic cleaning out of the axilla. Everyone knows how dreadful the results were before the cleaning out of the axilla became recognized as an essential part of the operation. Most of us have heard our teachers in surgery admit that they have never cured a case of cancer of the breast. The younger Gross did not save one case in his first hundred. Hayes Agnew stated in a lecture a very short time before his death that he operated on breast cancers solely for the moral effect on the patients, that he believed the operation shortened rather than prolonged life.

—*Cancer of the Breast*, 1894

For about 16 years our practice has been to cover the fresh defect, made as small as feasible in various ways, with large Thiersch grafts. The available skin was tucked high into the armpit in order to cover the axillary vessels, to obliterate the dead space under the clavicle, and to elevate to the highest possible point the axillary fornix.—*Developments in the Skin-Grafting Operation for Cancer of the Breast*, 1912

Tumors should never be harpooned, nor should pieces ever be excised from malignant tumors for diagnostic purpose. Breast tumors should not be incised on the operating table prior to their removal. The surgeon must learn to recognize malignant tumors not only with the microscope, but also with his naked eye and fingers. —*Adenocarcinoma of the Breast*, 1898

I have occasionally noticed that of my assistants perhaps one or two will see a trace of asymmetry in the skin tug on extreme displacement which the others are wholly unable to make out; and I have more than once in just such case of difference of opinion performed the complete operation for very small, deep seated cancers, without exploratory incision. Frequently there is no sign but this almost imperceptible suggestion of pull, which, when the faintest possible, is, of course, elicited by dislocation in one direction only. This sign, however slight, is all that is needed for the diagnosis. —*Cancer of the Breast*, 1907

It is to be hoped that others have reached the conclusion that we should not abandon as hopeless all cases of breast cancer in which there is supraclavicular involvement. Indeed, I fail to see why the neck involvement in itself is more serious than the axillary. The neck can be cleaned out just as thoroughly as the axilla. Dr. Bloodgood, Instructor in Surgery, has, on the necks of two patients, done as many as three operations each for glandular involvement, and apparently saved his patients.

Dr. H. W. Cushing, my house-surgeon, has in three instances cleaned out the anterior mediastinum on one side for recurrent cancer. It is likely, I think, that we shall in the near future remove the mediastinal contents at some of our primary operations.

—*Adenocarcinoma of the Breast*, 1898

We have cleaned out the supraclavicular fossa in 67 cases. Cancer was found in the tissues removed 23 times, or in 34 per cent of these cases. In 30 cases there was no cancer, and in 14 it is still uncertain whether the supraclavicular region was involved or not, because the tissues have not yet been exhaustively studied. Only those familiar with the work can under-

stand the amount of labor implied in the statement that a given mass of fat does not contain a cancer alveolus. —*Adenocarcinoma of the Breast*, 1898

On December 18, 1906, a partially occluding aluminum band was applied to the thoracic aorta about 7 cm. above the diaphragm, with the hope of influencing the progress of and relieving the excruciating pain caused by a large aneurysm of the upper abdominal aorta. A positive pressure box designed by Drs. Follis and Fisher was satisfactorily employed. Convalescence from the operation was without noteworthy incident.—*Clinical and Experimental Contributions to the Surgery of the Thorax*, 1909

In twenty-one consecutive thoracotomies there was only one primary infection of the thorax, and in this case no masks were used and a droplet contamination of the wound was noted in the account of the operation written immediately. Positive pressure was employed in all of the experiments, and by means of a very simple, effective, and very cheap apparatus devised by Dr. Gatch. The cost of the box was ten dollars. It was exhibited to the Association (American Surgical Association).—*Clinical and Experimental Contributions to the Surgery of the Thorax*, 1909

Occlusion of the main, the primary, and secondary divisions of the bronchi was practiced, various methods and almost all degrees of occlusion being tested. The lung was only occasionally excised. From complete occlusion of a bronchus by ligature or metal band there resulted atelectasis, with no apparent impairment of the health of the dog. . . . Particularly secure obliteration was accomplished by bisection of the bronchus, careful excision with the scalpel of its mucosa, and the approximation of the raw surfaces by a running suture of fine black silk. By this method the bronchus may be converted into a solid fibrous cord.

Ligation of the pulmonary arteries or veins to the lobes of one side produced no visible change in the color or consistence of the lobes during the period of operation. . . . Attempts to inoculate the lungs of dogs with tuberculosis were uniformly and rather unexpectedly successful (3 cases). Ligation of the pulmonary vessels, undertaken with the idea that possibly the infection might thereby be intensified or modified, was without demonstrable influence.

—*Contributions to Surgery of the Thorax*, 1909

Let the surgeon who is about to ligate a large artery bear in mind the following facts:

1. Fine ligatures cut through the arterial wall more rapidly than coarse ones.
2. Partially occluding ligatures and crushing ligatures are dangerous.
3. Absorbable ligatures may disintegrate unevenly, and thus a coarse ligature be reduced to a fine one; or the knot may slip and thus convert a total into a partial occlusion.
4. Intimal surfaces brought in contact cannot unite because the wall of the artery becomes necrotic under the coarcting ligature.
5. The necrosed wall under ideal conditions becomes converted into fibrous tissue, into a solid cord by the ingrowth of blood vessels from the ends.

—*Ligation of the Left Subclavian Artery*, 1921

Common errors in the treatment of aneurysms are the following: (1) opening the sac or pulsating hematoma without first making a temporary occlusion of all the possible sources of hemorrhage; (2) permanent ligation of a great arterial trunk as a precautionary measure in the search for a distal bleeding point; (3) ligation of a trunk too far from the aneurysm; (4) stuffing the wound with gauze to arrest hemorrhage; (5) drainage; (6) the employment of catgut for the ligature, or of silk that is too fine; (7) ligation of the artery proximal to an arteriovenous aneurysm or fistula. —*Ligation of Left Subclavian Artery*, 1921

There is abundant evidence in support of the view that, in a general way, the larger the artery, or the nearer it is to the heart, the less the impairment of the circulation attending its ligation. The subclavian, for example, may be tied quite without fear of gangrene, whereas from ligation of the axillary artery the circulation of the extremity is somewhat endangered, but not so much as from ligation of the brachial. Peripheral gangrene has not been observed in consequence of ligation of the aorta. It may occur after ligation of the common iliac, has occurred much more frequently after ligation of the popliteal artery in a considerable percentage of the cases.

—*Ligation of Common Iliac Artery*, 1912

If the sac had been excised at the primary operation of von Oppel the result would have taught us nothing —an opportunity would have been lost. I wish to emphasize this fact in the hope that surgeons may bear always in mind the opportunities which they have daily at the operating table to strive for results which may be contributory to the advancement of their science. The operating room is a laboratory for the surgeon. —*Ligation of Left Subclavian Artery*, 1921

It is undoubtedly the duty of every surgeon to familiarize himself by much practice on animals with the treatment of wounds of the heart and large blood vessels, veins and arteries, for otherwise he might be unable to cope properly with an emergency which, any day, may confront the active practitioner of this art. I would recommend the making of fistulae between the aorta and vena cava, the vena cava and portal vein, and between the innominate vessels. Also the practice of an end-to-end suture and the implantation of vessels. —*Ligation of Common Iliac Artery*, 1912

In the story of the development of the operation for goitre the essential history of surgery is comprised. The problem had been a pressing one for hundreds of years, and not only in countries where the majority of the population was affected with the disease. It could not be solved until surgeons had become proficient in the art of dealing with blood vessels. This art could not be acquired except by experience in operating. The experience could not be gained until anesthesia was discovered. With the introduction of anesthesia the number and magnitude of operations promptly increased. The knowledge acquired from the new op-

portunities soon manifested the need of better methods for controlling hemorrhage, and primitive forms of artery forceps were devised. From these, after a time, the artery clamp was evolved.

—*The Operative Story of Goitre*, 1920

Operation, March 26, 1835: First incision in the midline from the hyoid bone to the sternum; second incision through the middle of the tumor from right to left. The tumor was freed partly by incision, partly by enucleation in three parts. The arteries were situated laterally, and could be for the most part ligated before being cut. Several veins were ligated. In all 40 to 47 ligatures were applied. The patient lost about 1½ pounds of blood. The operation lasted one hour and ten minutes. At three o'clock the lips were colorless. *The patient was bled, six ounces of blood being removed.* Death at six o'clock.—*Roux: De l'extirpation d'un goitre. Arch. gen. de med., Paris*, 1836; *The Operative Story of Goitre*, 1920

The operation for goitre is one of the most thankless, most perilous undertakings, which, if not altogether prohibited, should at least be restricted to certain varieties of the malady. If, now, we again review all that we know from the writings of authors concerning operations upon large, uniformly hard or indeed scirrhous goitres, we can only regard with tremulous aversion these foolhardy performances.—*Johann Friedrich Dieffenbach: Die Operative Chirurgie. Leipzig*, 1848; *The Operative Story of Goitre*, 1920

The extirpation of the thyroid gland for goitre typifies, perhaps better than any operation, the supreme triumph of the surgeon's art. A feat which today can be accomplished by any really competent operator without danger of mishap and which was conceived more than one thousand years ago might appear an unlikely competitor for a place in surgery so exalted. There are operations today more delicate and, perhaps, more difficult, but they have followed naturally and easily in the paths made clear for them. But is there any operative problem propounded so long ago and attacked by so many which has cost so much thought and endeavor and so many lives before its ultimate solution was achieved? And further, is there any problem in surgery having required for its solution such intrepid throbbing and prolonged striving of the world's greatest surgeons which has yielded results so bountiful and so adequate?

—*The Operative Story of Goitre*, 1920

Special features of the operation which were more or less novel at the time of their introduction into our clinic:

1. Preservation of the superficial veins of the neck.
2. No muscle except the platysma is divided—not even the sternothyroid—except in case of large or adherent goitres.
3. The sternothyroid muscle is retracted outwards —occasionally split longitudinally.
4. Delivery and division of the superior pole before the remainder of the gland is dislocated.
5. Resection in place of total lobectomy in order to protect the parathyroid glands and the recurrent laryngeal nerve and to preserve a slice of thyroid in case an operation might have to be performed, possibly by another surgeon, on the opposite lobe.
6. Ultraligation (well beyond the origin of the parathyroid arteries) of the blood vessels, all of which are clamped before the lobe is resected.
7. Ligation of the inferior thyroid artery is not practiced.
8. Closure of the wound without drainage. This is made possible by the use of fine silk and the transfixion method for the absolute arrest of hemorrhage.

—*The Operative Story of Goitre*, 1920

Notwithstanding much speculation on the subject of various authors, it has not been made clear why Kocher's cases of cachexia strumapriva should have been so free from tetany, nor why Billroth's total extirpations should have been so frequently followed by tetany and should have so seldom manifested symptoms of thyroid deprivation. I have pondered this question for many years and conclude that the explanation probably lies in the operative methods of the two illustrious surgeons. Kocher, neat and precise, operating in a relatively bloodless manner, scrupulously removed the entire thyroid gland, doing little damage outside of its capsule. Billroth, operating more rapidly and, as I recall his manner (1879 and 1880), with less regard for the tissues and less concern for hemorrhage, might easily have removed the parathyroids or at least have interfered with their blood supply, and have left fragments of the thyroid.

—*The Operative Story of Goitre*, 1920

Weiss reported on 13 cases of tetany which he had collected—Billroth (Vienna) 8 cases; Albert (Vienna), 2 cases, Schönborn (Königsberg), 2 cases; Nicoladoni (Innsbruck), 1 case. The tetany had been observed only in young females and only after total extirpation of the gland. In three instances, it had appeared within 24 hours of the operation, but usually not until several days thereafter—once as late as the 10th day. He believes it highly probable that the ligation of so many blood vessels in the course of the goitre operation sets up an irritation of the peripheral sympathetic nerves, and thus, an excitation of the vascular centres of the cervical spinal cord and medulla, which in turn brings about changes observed by him in the gray substance; namely, in the anterior horns of the spinal cord.

—*The Operative Story of Goitre*, 1920

As to the cause of tetany Mikulicz was inclined to agree with Billroth who, in discussing Weiss's paper, had expressed himself as follows: "I am inclined, therefore, to lay especial stress upon the division of the numerous nerves of the thyroid gland, and believe that tetany occurs only in those individuals who are predisposed to nervous affections.

—*The Operative Story of Goitre*, 1920

The remarkable discoveries by Gley (1891–1892) and Vassale and Generali (1896) of the vital importance of the parathyroid glandules stimulated afresh my interest in the surgery of the thyroid gland and suggested experiments in transplantation of the tiny epithelial bodies (Epithelkörperchen). From these ex-

periments there resulted the general law that homografts of these glandules will not live, and that for the successful transplantation of autografts a considerable deficiency must be created. We made the startling and hardly believable observation that the life of a dog may be maintained by a particle of parathyroid tissue only one-quarter of a millimeter in diameter and extinguished by tetany on its removal.

—*The Operative Story of Goitre*, 1920

Summary of Experimental Observations:

1. The autotransplantation of parathyroid glandules into the thyroid gland and behind the musculus rectus abdominis has been successful in 61 per cent of the cases in which a deficiency greater than one-half has been created.
2. In no instance has the autotransplantation succeeded without the creation of such deficiency.
3. Isotransplantation has been uniformly unsuccessful.
4. Parathyroid tissue transplanted in excess of what is urgently required by the organism has not lived.
5. One parathyroid autograft may suffice to maintain the animal in good health and spirits for many months and possibly for years.

—*The Parathyroid Glands*, 1908

One of three plans may, as far as I am able to foresee, be followed by the surgeon who desires to save the parathyroids: (1) Slice through the thyroid gland in such a manner as to leave in situ and with intact blood supply the area in which the parathyroids usually lie. This does not absolutely guarantee the life of the parathyroids. (2) At the preliminary operation ligate the superior and inferior thyroid arteries with the expectation that the parathyroids will receive a peripheral (extrinsic) blood supply, and a week or two later perform the subcapsular operation. (3) Search for the parathyroids before ligating any vessels of the thyroid gland; demonstrate the precise origin of each parathyroid artery; continue in such manner as not to imperil the circulation of the parathyroid. For this procedure much practice on the cadaver is essential.

—*Preservation of the Parathyroids During Thyroidectomy*, 1907

The last word on the subject of intestinal suture may some day be written, but surely not until much experimental work has been done with an exactness not hitherto contemplated in investigations of this nature. Who knows, for example, how much of the intestinal wall should be turned in; whether two rows of stitching are better than one; whether the suture should be continuous or interrupted; whether the Lembert or mattress stitch is preferable; if the knots should be on the mucous or on the peritoneal surface; why some stitch-loops (knots outside) fall into the lumen and others remain on the peritoneal surface; who has considered the factors facilitating or delaying the release of the inturn.

—*Blind-End Circular Suture of the Intestine*, 1922

Not so very long ago a surgeon requested me to assist him to perform a circular suture of the intestine (end-to-end anastomosis) upon one of his patients. He readily consented to practice the operation upon dogs. At first his dogs died. He finally succeeded in saving more than 50 per cent of the dogs operated upon. The operation upon his patient required five hours, but was successful. It is not difficult to predict what the result would have been if the practice on dogs had been omitted . . .

I believe that the license to practice general surgery should be withheld from those who have not practiced on animals the operations for circular suture of the intestine and intestinal anastomosis.

—*Circular Suture of the Intestine*, 1898

Summary of Experimental Observations:

It is impossible to suture the serosa alone, as advised by authors.

It is impossible to suture unfailingly the serosa and muscularis alone, unless one is familiar with the resistance offered to the point of the needle by the coats of the intestine. Furthermore, stitches which include nothing but these two coats tear out easily, and are, therefore, not to be trusted.

Each stitch should include a bit of the submucosa. A thread of this coat is much stronger than a shred of the entire thickness of the serosa and muscularis.

—*Circular Suture of the Intestine*, 1887

Let those of us who are inclined to be content with our present methods of end-to-end anastomosis observe on animals the early stages of repair of our own intestinal sutures, to the end that we may understand the part that nature plays to protect the patient from the crudity of our handiwork.

—*Aseptic Intestinal Anastomosis*, 1922

That most cases of surgical tuberculosis will recover without operation if they are given a fair opportunity in the open air, I am convinced, nor should I be surprised if it proved to be, in general, an easily curable disease. My hardest task in the treatment of these cases has been to persuade the relatives and friends and alas, the physicians of patients, of the necessity of taking so much trouble, of instituting a disturbance of the even tenor of the family's existence or of involving themselves in such unanticipated expenditure. I have submitted the pros and parried the cons with the parents for hours, and until so weary of the battle that I have vowed never again to misplace so much energy. But interest in the subject, as great occasionally as in the particular patient, has usually stimulated a renewal of the attack. . . .

I am, therefore, under great obligations to the patients who have so courageously and with such implicit trust yielded to my very earnest solicitations to exile themselves for a winter at least. Today we cannot well realize the amount of faith which this required 15 years ago, when not a single precedent could be cited, when one could indicate no case of surgical tuberculosis which had been treated in even a most desultory out-of-door fashion, and when patients, encouraged to believe that they would get well if they remained at home and indoors, asked me to explain how mountain air, inhaled ever so deeply, could reach the bone.

—*Results of the Open Air Treatment of Surgical Tuberculosis*, 1905

A warning for all time against satisfaction with present achievement and blindness to the possibilities of future development is the imperishable prophecy of the famous French surgeon, Baron Boyer, who over a hundred years ago declared that surgery had then reached almost, if not actually, the highest degree of perfection of which it was capable.

Could Boyer, we ask, have been satisfied with the status of surgery when anesthesia was undiscovered, when hemorrhage was awkwardly and insufficiently controlled, when infection of wounds was not understood and could not be prevented? And yet I might quote from the writings of distinguished men of our time to show that even today some think that surgery is almost complete.

Anesthesia, one of the greatest blessings, is at the same time one of our greatest reproaches, hemorrhage is still awkwardly checked, and of surgical infection once started we have often little control and then mainly by means of the knife. We have reason to hope that the day will come when hemorrhage will be controlled by a quicker procedure than the awkward, time-consuming ligature; when infections will be controlled by specific products of the laboratory; and when pain will be prevented by a drug which will have an affinity only for the definite sensory cells which it is desirable it should affect. The first of these may be last and the last first. Let us trust that it may, as Gross expresses it, "be a long time before the laws of this department of the healing art will be as immutable as those of the Medes and Persians."

—*The Training of the Surgeon*, 1904

I have touched my subject only very lightly at some of the higher points. Hardly enough has been said even to make it clear that an enormous amount of work underlies the facts which we at present possess. It must be evident to everyone, however, that there reigns the greatest confusion on the subject of the function of the glands of internal secretion.

Fortunately, the ardor for research on our globe is not diminished by the conviction that we are laboring in the wake of workers infinite in numbers on countless worlds who have carried their investigations millions of years beyond the stage reached by us, and are rapidly progressing towards an ultimate solution which may never be reached. —*The Thymus Gland*, 1914

In reviewing these excerpts it is unnecessary to emphasize their originality, their audacity and their recurring timeliness, and present applicability. In addition to his commonly known contributions they bring to light evidence that as early as 1906 he had employed positive pressure anesthesia in performing a thoracotomy and in intrathoracic experiments upon animals as well. It is worth noting further that in 1905 he predicted the development of better methods to control infection and hemorrhage, predictions which only recently have found fulfillment in the antibiotics and in the Bovie machine; that as early as 1890 he antedated Rollier in the use of the open air treatment for surgical tuberculosis. In the surgical hall of fame, one must accord Halsted's name a prominent place among its pioneering leaders.

REFERENCES

1. Carter, B. Noland. The fruition of Halsted's concept of surgical training. Surgery, 1952, 32: 518.
2. Da Costa, J. C. Modern Surgery; General and Operative. Philadelphia and London: W. B. Saunders Co., 1918.
3. Halsted, William Stewart. Surgical Papers. Baltimore: The Johns Hopkins Press, 1924; reprinted 1952.

Reviews of New Books

ONLY THE PHYSIOLOGIST familiar with the study of pulmonary function will fully appreciate the value of the 80 page monograph entitled *Patho-Physiologie der Atmung in der Lungenchirurgie*[1] by J. Maurath of Tübingen. The work and experience of several years seems to be compressed in this little volume, and only one-half concerns findings in patients on whom pulmonary surgery was performed. The primary interest of this part lies in the comparison of the effects which different surgical procedures will have on respiration. Segmental resection has yielded almost as great a decrease of the maximal breathing capacity (26 per cent) as did pneumonectomy (29 per cent). There is an "experimental part" of 24 pages in which some interesting findings in patients with predominantly chronic "lung disease" of varying severity are reported. To give just one example: Retention of carbon dioxide was found in the presence of normal oxygen saturation in the blood of patients with mild forms of pulmonary disease, and was more marked and associated with azotemia in patients with chronic hypoxemia breathing pure oxygen.

The more important tests of pulmonary function are described and discussed. Spirometry, including determination of maximal breathing capacity and timed capacity measurements, and bronchospirometry have been most helpful to the author in connection with pulmonary surgery, and it is advocated that these be done, if at all possible, whenever pneumonectomy is contemplated.

The binding, print, and illustrations are good, and many references to the literature are given.

—*F. H. Moser.*

THE FIRST REVISION of *Abdominal Operations*[2] since 1948 represents a monumental task. There are 1,580 pages, so that at first glance the volume is a little overwhelming. However, inspection of the book discloses that only the more important parts from the previous edition have been retained, and the reader is not overwhelmed when he realizes that everything possible has been done to present the subject in a clear, concise, and, at the same time, delightful style.

The strongest point of the entire work is the emphasis on illustrations. These are profuse and beautifully done. They are drawings made from photographs and charts and actually are more instructive than mere photographs alone. If there is any single detail to set this book apart from others of its kind, it is the generous use of illustrations.

One very minor criticism is the author's tendency to present many facets of controversial items and to include the teachings of all his predecessors. Most readers, knowing Rodney Maingot as they do and being keenly aware of his own stature, would be well satisfied with his own conclusion in certain instances.

The adherence to the outline form, wherever practical, strikes one as being an extremely good feature. The narrative is detailed wherever necessary, and yet quick reference is possible because of clear titling and subtitling, so that unneeded detail may be passed over easily. One very welcome addition to this book, which is not common in books of this type, is the use of photographs of such things as instruments, surgical equipment, and postoperative gear. This makes crystal clear just what the author is referring to in the narrative or outline form.

As might be expected, one of the strongest sections deals with peptic ulcer. Here a very short reference to historical factors is combined with the very latest advances, and the volume derives great impact from the fact that these are inserted in their most telling positions. The use of inserts for bibliographic reference is convenient also, as the reference is given in continuous form and one is not forced to hunt laboriously through a terminal index or a bottom-of-the-page list.

It is of great satisfaction to the American surgeon to note that American authorities are referred to often and with appropriate credit. Many of the chapters are written by outstanding American surgeons, and a very friendly attitude is maintained throughout.

Tremendous importance is attached to technical detail, so that, in this one volume, not only may the beginning surgeon just finishing his residency find a veritable treasury of information, but also the accomplished surgeon about to embark upon a less familiar procedure will find just about everything he needs for many of these operations.

This edition represents a drastic revision of the 1948 edition, and there are 11 new chapters. The volume is the culmination of a tremendous task and will stand as a fitting salute to an outstanding surgeon.

—*Edward S. Judd, Jr.*

THE VOLUME entitled *The Abnormal Pneumoencephalogram*[3] by Davidoff and Epstein is a natural sequel to *The Normal Pneumoencephalogram* by Davidoff and Dyke. The anatomy and normal ventricular patterns are adequately covered in the volume on the normal encephalogram. However, the introduction adequately discusses technique and interpretation of the plain skull roentgenogram and the pneumoencephalogram. The make-up of the book as to size, quality of paper, print and ease in reading, and quality of illustrations is exceptionally good. The authors are deserving of praise for the detail of the table of contents. It allows easy and ready reference without undue thumbing or search for a particular lesion.

The second edition is an improvement over the first in that a few minor additions have been added, such as the placing of arrows pointing to lesions which,

[1] PATHO-PHYSIOLOGIE DER ATMUNG IN DER LUNGENCHIRURGIE. By Dr. Med. J. Maurath. With a foreword by Prof. Dr. Th. Naegeli. 80 pages, 31 illustrations. DM 19.50. $4.65. Stuttgart: Georg Thieme Verlag, 1955.

[2] ABDOMINAL OPERATIONS. By Rodney Maingot, F.R.C.S. (Eng.). 3rd ed. 1,580 pages, 1,594 illustrations. $24.50. New York: Appleton-Century-Crofts, Inc., 1955.

[3] THE ABNORMAL PNEUMOENCEPHALOGRAM. By Leo M. Davidoff, M.D., and Bernard S. Epstein, M.D. 2nd rev. ed. 518 pages, 291 figures. $15.00. Philadelphia: Lea & Febiger, 1955

otherwise, are recognized with some difficulty in reproductions of x-ray films. The bibliography has been brought up to date, although the number of additions is relatively small.

The first section of the book considers the neoplasms and articular changes according to location. For example, a chapter each is devoted to tumors in the frontal, parietal, occipital, and temporal lobes, and tumors in other portions of the brain such as the anterior portion of the third ventricle, corpus callosum, and the posterior cranial fossa.

The second section deals with non-neoplastic lesions, including subdural hematomas, cerebral hemorrhage and thrombosis, cerebral atrophy, intracranial aneurysms, meningoceles, congenital malformations, and even rare infections of the nervous system.

After careful reading of this excellent book, the reviewer was unable to think of any lesion that had not been adequately covered, or to make any criticism not complimentary in every way. This volume should be in the library of everyone who deals with neurologic diseases or injuries, or with the x-ray examination of patients with such problems. —*David Cleveland.*

THE USE OF CYTOLOGIC STUDY for the diagnosis of lung cancer has met with a certain reluctance among German investigators, but in recent years a few authors have reported their own, encouraging experiences. G. Kahlau particularly has stressed the importance of this procedure in his excellent, very comprehensive survey on lung cancer (*Erg. allg. Path.*, Vol. 37), and so does—convincingly—P. Hartmann in his monograph entitled *Die Cytologie des Bronchialsekretes.*[4]

After a historical review, P. Hartmann describes and discusses the morphology of normal and pathologic cells, including intermediate forms, such as cells which have undergone autolytic changes or epithelial metaplasia. The methods commonly employed for collection, preparation, and staining of material are reviewed (the Papanicolaou method in detail). In Europe the section technique is used more often than in this country where smears are preferred, but the results (from experts) are comparable. The criteria and accuracy of diagnosis as reported in the world literature are critically evaluated and his own figures are presented. The author has not made sputum examinations, and when using the bronchoscope he finds it most satisfactory to collect secretions by wiping the bronchial mucosa with a cotton ball on a stick, after having aspirated excessive secretions. In 134 cases of proved bronchogenic carcinoma he made a correct positive diagnosis in 71.6 per cent; there were 7.7 per cent false positives. The photomicrographs are excellent, and the 256 references to the literature show that the author has read and digested the publications in his own and other languages. — *F. H. Moser.*

THE AUTHOR of *Fractures in Children,*[5] Walter P. Blount, has produced a splendid book, worthy of careful study by every general practitioner of medicine and particularly by every surgeon aspiring to work in the field of bone surgery.

He lays great emphasis on three fundamentals: (1) intelligent conservatism in the treatment of fractures in children; (2) the necessity of treatment of the patient rather than merely the fractured bone; (3) the need for careful follow-up of any bone injury, with reservation as to prognosis, until the growth of the bone has been completed.

By stressing the need for thorough acquaintance with the normal development of every bone, a close familiarity with all centers of ossification, a knowledge of their normal time of fusion, and the expected time of closure of all epiphyseal lines the author lays a background of information for the student which will minimize the likelihood of errors in x-ray diagnosis and encourage the adoption of sound principles of treatment. In no other way can unnecessary mistakes be avoided.

Each chapter begins with a sound general discussion of the problems relating to fractures in each field, and this is followed up by typical roentgenograms, showing not only the relationship of the bone fragments immediately after injury, and the change in their position incident to reduction, but (and this is most important) late films showing the progress in the repair of the fracture after several years, and the influence of the trauma on the rate of growth of the bone. In this way the reader gets a pretty fair notion as to what the end result might be.

When occasion demands it, drawings accompany the text to describe types of apparatus recommended, and now and then pertinent cartoons are inserted which carry important messages.

All in all, I am much impressed with this book and strongly recommend it. —*Edwin M. Miller.*

PROBABLY FEW SURGICAL CONTRIBUTIONS of the many that appear from the presses of American publisher-represent the combined efforts and studied conclusions of so many able men as do these 2 small volumes entitled *An Outline of the Treatment of Fractures*[6] and *Early Care of Acute Soft Tissue Injuries.*[7] To cite the list of contributors would simply be a roll call of distinguished surgeons who have given time and thought to presenting in simple and concise fashion the basic principles of fracture and wound treatment.

The first edition of *An Outline of the Treatment of Fractures* appeared in 1931. The new fifth edition, only 90 pages in length, is a primer that should be required study for every medical student and intern.

The Early Care of Acute Soft Tissue Injuries is a more ambitious project and in 22 brief chapters outlines first, the principles of treatment of injuries and in succeeding chapters the treatment of injuries of head, spinal cord, face, eye, neck, thorax, abdomen, genitourinary tract, and the extremities. There are additional chapters on peripheral nerve injuries, hand injuries, amputations, wounds of joints, vascular in-

[4]DIE CYTOLOGIE DES BRONCHIALSEKRETES. By Dr. Med. P. Hartmann. 112 pages, 68 illustrations. DM 24.—Stuttgart: Georg Thieme Verlag, 1955.

[5]FRACTURES IN CHILDREN. By Walter Putnam Blount, A.B., M.D., F.A.C.S. 279 pages, 311 illustrations. $9.50. Baltimore: The Williams & Wilkins Co., 1955.

[6]AN OUTLINE OF THE TREATMENT OF FRACTURES. By the Committee on Trauma. 5th rev. ed. 93 pages, 45 illustrations. $1.00. Chicago: American College of Surgeons, 1954.

[7]EARLY CARE OF ACUTE SOFT TISSUE INJURIES. By the Committee on Trauma. 192 pages. $1.00. Chicago: American College of Surgeons, 1954.

juries, burns, shock, antibiotics and antisera, anesthesia in the care of the injured, and immunization for tetanus and gas gangrene.

In some hospitals generous staff members have provided copies of these manuals for each member of the intern and resident staff. If their example were widely followed one feels certain there would result definite improvement in the emergency care of the many patients with fractures and open wounds who form a constantly increasing percentage of the patients seeking hospital admission and care. —*Sumner L. Koch.*

STUTZ AND VIETEN'S *Bronchography*[8] is a very thorough and up-to-date review of the subject. What the authors remark in the chapter on tuberculosis could well be said of the entire volume—that other clinical, endoscopic, and roentgenologic methods find very little mention should not be construed as indicative of their diagnostic value.

The 250 page book consists of 4 main parts. In part A is discussed the method and its application. Water soluble contrast media are being used almost exclusively, and give very satisfactory pictures. Their only disadvantage is that they are more irritating to the bronchi than oily substances, but this is outweighed by the many drawbacks of the iodine-oil products (high surface tension, slow elimination, granuloma formation, hypersensitivity reactions). For application of media the authors advocate the use of a metal probe or a semirigid catheter, which allows directed and selective instillation into the bronchi. Naturally, water soluble media and directed instillation require more anesthesia. Cocaine, being too dangerous, has been replaced by para-aminobenzoic acid derivatives of the novocain type.

Part B concerns the anatomy of the bronchial tree. The normal and pathologic physiology is the subject of part C, in which mechanism of bronchial filling, respiratory and nonrespiratory movement of the bronchial tree, cough, bronchospasm, and bronchial asthma are discussed. Lastly, in part D, a wide scope of clinical conditions in which bronchography can be employed is presented in the following order: bronchitis, pneumonia, bronchiectasis, lung abscess, tuberculosis, neoplasms, middle lobe syndrome, silicosis, foreign bodies, extrapulmonary lesions causing displacement, congenital malformations, fistulas, postoperative states, traumatic rupture of bronchus, and others (lues, actinomycosis, aspergillosis, Hodgkin's disease, echinococcus cyst).

If one disregards an occasional statement that is of local validity or outdated (such as "amongst mycotic infections of the lung actinomycosis is the most important"), one can certainly congratulate the authors for an outstanding contribution, which is of great value for information and reference. Roentgenologists and clinicians who limit bronchography to diagnosis and to follow-up observations of bronchiectasis may increase their indication after reading this book, although one must admit that many of the disorders given do not require bronchography in most instances, and even the advent of modern thoracic surgery has not greatly expanded the indications for bronchography.

The binding, print, and illustrations are of high quality, and 1,654 references to the literature are listed alphabetically at the end. —*F. H. Moser.*

THE VOLUME entitled *A Textbook of Physiology*[9] is the third revision undertaken by Fulton and his collaborators of *Howell's Textbook of Physiology* which first appeared in 1905 and carried his name for 14 editions. As Howell's first edition was the outgrowth of *An American Textbook of Physiology*, written by Howell and a number of others, the lineage of the present book extends beyond the half century mark. During all of this time it has merited the prestige of being considered a top ranking text in its field. Although the present edition represents the writing of 30 authors (many of whom were not yet born when the first edition appeared) and the numerous contributions and discoveries which have been made during the past 50 years result in a book which bears scant resemblance to its progenitor, nevertheless, the book still shows much of the original organization and even a few of the original illustrations. One may be astonished to find that there is no chapter devoted to the physiology of the liver and that the manifold activities of this organ are interwoven into the discussions of metabolism and digestion. The major weakness in this reviewer's opinion is the sketchiness of the index, such items as Bezold-Jarish effect, gastrin, jaundice, leucopenia, Hering Breuer reflex, and Traube-Hering waves not being included. On the whole the book is a very worthy representative of a proud tradition of excellence and shows a minimum of the disjointedness which might be expected of a multiple author text. This multiple authorship is responsible for a remarkably up-to-date coverage of the literature. The physical make-up is excellent, and the 600 illustrations are well done and instructive. —*Carl A. Dragstedt.*

IT IS A PLEASURE TO REVIEW the monograph of 207 pages entitled *Surgery of Face, Mouth, and Jaws*[10] written by Frank McDowell, James Barrett Brown, and Minot P. Fryer.

The sectional discussions of examination and the technical considerations including instrumentation and postoperative care are brief but very comprehensive. Inflammatory processes, traumatic injuries, and congenital anomalies are discussed fully, thoroughly, and concisely. The last 3 sections deal with benign and malignant tumors, and the indications, operative techniques, and results following radical neck dissection.

The text is well illustrated; drawings, preoperative and postoperative photographs, and reproductions of radiographs are all utilized.

[8]ARCHIV UND ATLAS; DER NORMALEN UND PATHOLOGISCHEN ANATOMIE IN TYPISCHEN ROENTGENBILDERN. DIE BRONCHOGRAPHIE. By Dr. Ernst Stutz and Dr. Heinz Vieten. 250 pages, 181 illustrations. DM 66.— Stuttgart: Georg Thieme Verlag, 1955.

[9]A TEXTBOOK OF PHYSIOLOGY. Edited by John F. Fulton, M.D. 17th ed. 1,275 pages, 600 illustrations. Philadelphia and London: W. B. Saunders Co., 1955.

[10]SURGERY OF FACE, MOUTH, AND JAWS. By Frank McDowell, M.D., James Barrett Brown, M.D., and Minot P. Fryer, M.D. 213 pages, 168 illustrations. $6.50. St. Louis: The C. V. Mosby Co., 1955.

As a text presenting the diagnosis and treatment of lesions of the face, mouth, and jaws, this book is a ready and practical reference and will prove a worthwhile addition to the library of the student as well as to every member of the medical and dental professions. —*Frank D. Bernard.*

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

VIROSIS MATERNA Y MALFORMACIONES FETALES; EL PROBLEMA DEL ABORTO PROVOCADO. By Dr. Juan Livio Martini. 79 pages. Buenos Aires, 1955.

DIAGNOSTICO DEL DOLOR ABDOMINAL AGUDO. By William Requarth, M.D. Translated into the Castilian by Dr. Mariano M. Lopez. 209 pages, 79 illustrations. Buenos Aires: Editorial Artecnica, 1955.

DISEASES OF THE EAR, NOSE AND THROAT. By William Wallace Morrison, M.D. 2nd ed. Foreword by Arthur W. Proetz. 756 pages, 359 illustrations. $10.00. New York: Appleton-Century-Crofts, Inc., 1955.

UEBER DEN EINFLUSS DER SCHWANGERSCHAFT AUF DIE LUNGENTUBERKULOSE. By Dr. med. Klaus Obmann. 143 pages, 216 illustrations. DM 25. Leipzig: Veb Georg Thieme, 1955.

INTESTINAL OBSTRUCTIONS; PHYSIOLOGICAL, PATHOLOGICAL, AND CLINICAL CONSIDERATIONS WITH EMPHASIS ON THERAPY, INCLUDING DESCRIPTION OF OPERATIVE PROCEDURES. By Owen H. Wangensteen, B.A., M.D., Ph.D. 3rd ed. 838 pages, 200 illustrations. $15.50. Springfield, Ill.: Charles C Thomas, 1955.

ERLAEUTERUNGEN ZU DEN STRAHLENSCHUTZNORMEN DUER MEDIZINISCHE ROENTGENEINRICHTUNGEN-, ANLAGEN UND ROENTGENSCHUTZKLEIDUNG DIN 6811, 6812, 6813. By H. Graf and A. Schall. 90 pages, illustrated. DM 8.70. Stuttgart: Georg Thieme Verlag, 1955.

BLOOD SUPPLY AND ANATOMY OF THE UPPER ABDOMINAL ORGANS WITH A DESCRIPTIVE ATLAS. By Nicholas A. Michels, M.A., D.Sc. (Louvain). 581 pages, 172 illustrations (166 in color). $24.00. Philadelphia, Montreal: J. B. Lippincott Co., 1955.

ANNOTATED BIBLIOGRAPHY OF VITAMIN E, 1952–1954. Vol. III. 182 pages. Compiled by Philip L. Harris and Wilma Kujawski of The Research Laboratories of Distillation Products Industries, Rochester, New York (Division of Eastman Kodak Co.), 1955.

THE SURGERY OF THEODORIC. Translated from the Latin by Eldridge Campbell, M.D., and James Colton, M.A. Vol. I, Books I and II. 223 pages. $5.50. New York: Appleton-Century-Crofts, Inc., 1955.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by Richard M. Hewitt, B.A., M.A., M.D., A. B. Nevling, M.D., John R. Miner, B.A., Sc.D., James R. Eckman, A.B., M.A., Ph.D., M. Katharine Smith, B.A., Carl M. Gambill, A.B., M.D., M.P.H., Florence Schmidt, B.S.E., and George G. Stilwell, A.B., M.D. Vol. XLVI. 843 pages, 189 figures. $12.50. Philadelphia, London: W. B. Saunders Co., 1955.

DIFFERENTIAL DIAGNOSIS; THE INTERPRETATION OF CLINICAL EVIDENCE. By A. McGehee Harvey, M.D., and James Bordley, III, M.D. 665 pages. $11.00. Philadelphia, London: W. B. Saunders Co., 1955.

THE PRACTICE OF DYNAMIC PSYCHIATRY. By Jules H. Masserman, M.D. 790 pages. $12.00. Philadelphia, London: W. B. Saunders Co., 1955.

SURGICAL FORUM; PROCEEDINGS OF THE FORUM SESSIONS FORTIETH CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS, ATLANTIC CITY, N. J., NOVEMBER, 1954. Committee on Forum on Fundamental Surgical Problems: Harris B. Shumacker, Jr., M.D., F.A.C.S., Chairman. 851 pages. $10.00. Philadelphia, London: W. B. Saunders Co., 1955.

PATHOLOGY FOR THE SURGEON. By William Boyd, M.D. (Edin.), Dipl. Psychiat. (Edin.), F.R.C.S. (Canada), F.R.C.S. (Lond.), M.R.C.P. (Edin.), F.R.S. (Canada), LL.D. (Sask.), D.Sc. (Man.), M.D. (Oslo). 7th ed. 737 pages, 547 illustrations (10 in color). $12.50. Philadelphia, London: W. B. Saunders Co., 1955.

A TEXTBOOK OF MEDICINE. Edited by Russell L. Cecil, M.D., Sc.D., and Robert F. Loeb, M.D., Sc.D., D.Hon.Causa., LL.D. Associate Editors, Alexander B. Gutman, M.D., Ph.D., Walsh McDermott, M.D., and Harold G. Wolff, M.D. 9th ed. 1,786 pages, illustrated. $15.00. Philadelphia, London: W. B. Saunders Co., 1955.

HISTOLOGISCHE GESCHWULSTDIAGNOSTIK; SYSTEMATISCHE MORPHOLOGIE DER MENSCHLICHEN GESCHWUELSTE ALS GRUNDLAGE DUER DIE KLINISCHE BEURTEILUNG. By A. v. Albertini. 544 pages, 638 illustrations. DM 98.40. Stuttgart: Georg Thieme Verlag, 1955.

DIE OCCIPITO-CERVICAL-GEGEND; EINE DIAGNOSTISCH-PATHOGENETISCHE-PATHOGENETISCHE STUDIE. By Priv.-Doz. Dr. J. E. W. Brocher. 145 pages, 91 illustrations. DM 48.— Stuttgart: Georg Thieme Verlag, 1955.

LES CANCERS DU COLON. By Marcel Roux and F. Carcassonne, in collaboration with R. LeCanuet. 368 pages, 140 figures. 3.200 fr. Paris: Masson et Cie, 1955.

OXYGENOTHERAPIE. By Leon Binet and Madeleine Bochet. 180 pages, 28 figures. 1.300 fr. Paris: Masson et Cie, 1955.

GASTROILEOSTOMIA INADVERTIDA; CONTRIUICAO PARA O SEU ESUDO CLINICO, RADIOLOGICO E ANATOMOPATOLOGICO. By Mario Ramos de Oliveira. Tese para concurso de livre docencia de clinica cirurgica, apresentada a facultade de medicina da Universidade de Sao Paulo. 229 pages, illustrated. Sao Paulo, 1955.

CIRURGIA DE LAS INFECCIONES MAXILARES Y PERIMAXILARES; CLINICA Y TRATAMIENTO. By Jose Yoel and Eldo A Bilesio. 204 pages, 134 illustrations.

AMERICAN COLLEGE OF SURGEONS

ALFRED BLALOCK, Baltimore, *President*
WARREN H. COLE, Chicago, *President-Elect*

PRELIMINARY PLANS FOR THE 41st CLINICAL CONGRESS THE CONRAD HILTON HOTEL, CHICAGO, ILLINOIS OCTOBER 31 TO NOVEMBER 4, 1955

DEVELOPMENT OF THE PROGRAM for the Clinical Congress has come a long way since its inception in 1910, prior to the founding of the College with which it was joined in 1913. Ideals and objectives of the program—postgraduate education of the surgeon—have not wavered, however, and to this end the five day meeting has become more valuable each year.

The Clinical Congress is now internationally renowned for the high quality of its sessions, and physicians and surgeons from all parts of the nation and from a number of foreign countries attend the postgraduate courses, panel discussions, symposia, surgical forums, ciné clinics, motion pictures, telecasts, exhibits.

This issue of the Journal presents still more information about the program. The October issue will carry the final program.

General Sessions

General sessions will begin promptly at 10 a.m. on Monday morning. An outline follows:

MONDAY, 10 a.m.—Surgery of the Thyroid. Panel Discussion. Moderator: RICHARD B. CATTELL, Boston. Collaborators: THOMAS J. ANGLEM, Brookline, B. MARDEN BLACK, Rochester, Minn., HOWARD A. PATTERSON, New York; 1:30–3 p.m.—Clinicopathology Conference. Moderator: EDWIN F. HIRSCH, Chicago. Collaborators: to be announced; 3:30–5 p.m.—Parenteral Therapy. Panel Discussion. Moderator: CARL A. MOYER, St. Louis, Missouri. Collaborators: WILLIAM E. ABBOTT, Cleveland, HALVOR N. CHRISTENSEN, Boston, DAVID V. HABIF, New York.

TUESDAY, 1:30–3 p.m.—Carcinoma of the Breast. Panel Discussion. Moderator: CLARENCE E. GARDNER, JR., Durham. Collaborators: SIR STANFORD CADE, London, England, HERBERT WILLY MEYER, New York, THOMAS G. ORR, SR., Kansas City, Kan., HENRY T. RANDALL, New York; 3:30–5 p.m.—Surgery in Patients with Cardiac Disease. Panel Discussion. Moderator: CHARLES G. JOHNSTON, Detroit. Collaborators: WRIGHT R. ADAMS, Chicago, STUART C. CULLEN, Iowa City, RUDOLF J. NOER, Louisville.

WEDNESDAY, 1:30–3 p.m.—Surgery and Anesthesia Panel Discussion. Moderator: FRANK GERBODE, San Francisco. Collaborators: FRANK F. ALLBRITTEN, JR., Kansas City, Kan., STUART C. CULLEN, Iowa City, PAUL R. DUMKE, Detroit, FRANCIS D. MOORE, Boston; 3:30–5 p.m.—Benign Lesions of the Pancreas. Panel Discussion. Moderator: JOHN H. MULHOLLAND, New York. Collaborators: HENRY DOUBILET, New York, PHILIP F. PARTINGTON, Cleveland, KENNETH W. WARREN, Boston.

THURSDAY, 1:30–3 p.m.—Surgery of the Colon. Panel Discussion. Moderator: CLAUDE F. DIXON, Rochester, Minn. Collaborators: A. STEPHENS GRAHAM, Richmond, Virginia, JESSIE C. GRAY, Toronto, THOMAS M. MILLAR, Edinburgh.

FRIDAY, 9–12 noon.—What's New in Surgery? HARRIS B. SHUMACKER, JR., Presiding. The Presiding Officers of seven Surgical Forum Sessions will summarize the outstanding research developments in their respective fields.

Surgical Specialties

GYNECOLOGY AND OBSTETRICS

This year's program has been enlarged to meet the demand for inclusion of a larger num-

ber of sessions devoted to subjects in obstetrics.

MONDAY, 1:30–3 p.m.—The Place of the "D & C" in Gynecology. Panel Discussion. Moderator: LEWIS C. SCHEFFEY, Philadelphia. Collaborators: ROGER B. SCOTT, Cleveland, EMANUEL L. HECHT, New York, JOHN ROCK, Brookline; 3:30–5 p.m.—Cesarean Section. Panel Discussion. Moderator: CURTIS TYRONE, New Orleans. Collaborators: A. CHARLES POSNER, New York, H. HUDNALL WARE, JR., Richmond, EDWARD G. WATERS, Jersey City.

TUESDAY, 1:30–3 p.m.—Conservation of Ovarian Tissue. Panel Discussion. Moderator: JOHN MCLEAN MORRIS, New Haven. Collaborators: WILLARD M. ALLEN, St. Louis, CLYDE L. RANDALL, Buffalo, JOHN ARTHUR STALLWORTHY, Oxford, England; 3:30–5 p.m.—Estimation of Pelvic Size. Panel Discussion. Moderator: M. EDWARD DAVIS, Chicago. Collaborators: WILLIAM F. MENGERT, Dallas, CHARLES M. STEER, New York.

WEDNESDAY, 1:30–3 p.m.—Blood Clotting Problems in Obstetrics. Panel Discussion. Moderator: DUNCAN E. REID, Boston. Collaborators: C. PAUL HODGKINSON, Detroit, WILLIAM C. MOLONEY, Boston, DANIEL J. MULLANE, Boston; 3:30–5 p.m.—Studies in the Radiosensitivity of Tumors. Panel Discussion. Moderator: SAUL B. GUSBERG, New York. Collaborators: JOHN B. GRAHAM, Boston, JOHN L. MCKELVEY, Minneapolis, FRANKLIN L. PAYNE, Philadelphia, JAMES W. REAGAN, Cleveland.

THURSDAY, 1:30–3 p.m.—Surgical Forum Reports in Gynecology and Obstetrics.

FRIDAY, 1:30–3 p.m.—Hazards of Fetal Existence. Panel Discussion. Moderator: JOHN PARKS, Washington, D.C. Collaborators: TOMMY N. EVANS, Ann Arbor, ARTHUR B. HUNT, Rochester, Minn., F. JACKSON STODDARD, Milwaukee; 3:15–5 p.m.—Care of Patient Under Radiation Therapy. Panel Discussion. Moderator: HERBERT E. SCHMITZ, Chicago. Collaborators: LANGDON PARSONS, Boston, HENRY L. SCHMITZ, Chicago, FRANK R. SMITH, New York.

NEUROLOGIC SURGERY

THURSDAY, 9–10:30 a.m.—The Management of Facial Pain. Symposium. Chairman: BRONSON S. RAY, New York. Participants: Surgical Treatment of Tic Douloureux (Including Glossopharyngeal Neuralgia and Exclusive of Injections and Medical Treatment). GEORGE S. BAKER, Rochester, Minn.; Non-Surgical Treatment of Tic Douloureux (Including Injection Methods and Medical Therapy). GUY L. ODOM, Durham; Atypical Facial Neuralgia and Allied Facial Pain. HARRY WILKINS, Oklahoma City.

10:35–12:00—The Surgical Management of Upper Extremity Pain. Symposium. Chairman: E. S. GURDJIAN, Detroit. Participants: FRANCIS ASBURY ECHLIN, New York, FRANK H. MAYFIELD, Cincinnati, JOHN RAAF, Portland, Oregon.

FRIDAY, 1:30–3 p.m.—Symposium: Present-Day Evaluation of Hypothermia in Neurosurgery. E. HARRY BOTTERELL, Toronto; Present-Day Evaluation of Cordotomy. EDGAR A. KAHN, Ann Arbor; An Evaluation of Present-Day Management of Hydrocephalus. DONALD D. MATSON, Boston; An Evaluation of Present-Day Management of Involuntary Movements. A. EARL WALKER, Baltimore.

ORTHOPEDIC SURGERY

FRIDAY, 9–12:00—Fractures of the Lower End of the Radius and Fractures of the Carpal Bones. Panel Discussion. Moderator: JESSE T. NICHOLSON, Philadelphia. Collaborators: C. FRED FERCIOT, Lincoln, Neb., HARRISON L. MCLAUGHLIN, New York, RALPH SOTO-HALL, San Francisco, PAUL B. STEELE, Pittsburgh; 1:30–3 p.m.—Differential Diagnosis and Treatment of Neck, Shoulder and Arm Pain. Panel Discussion. Moderator: JOSEPH A. FREIBERG, Cincinnati. Collaborators: EDGAR F. FINCHER, Emory University, FRANK H. MAYFIELD, Cincinnati, WILLIAM BEECHER SCOVILLE, Hartford, FRANCIS P. WALSH, Detroit.

PLASTIC SURGERY

FRIDAY, 1:30–3 p.m.—Experience in Tissue Banking and Problems of Tissue Transplantation. Panel Discussion. Moderator: GEORGE W. HYATT, Bethesda, Md. Collaborators: GLENN H. ALGIRE, Bethesda, MINOT P. FRYER, St. Louis, JOHN SAVILLE, Bethesda, Md.; 3:15–5 p.m.—Carcinoma of the Face, Mouth, Jaw and Neck. Panel Discussion. Moderator: WILLIAM F. MACFEE, New York. Collaborators: TRUMAN C. BLOCKER, JR., Galveston, LOUIS T. BYARS, St. Louis, JOSEPH E. MURRAY, Boston.

THORACIC SURGERY

FRIDAY, 1:30–3 p.m.—The Surgical Management of Cystic Diseases of the Lung and Spontaneous Pneumothorax. Panel Discussion. Moderator: LYMAN A. BREWER III, Los Angeles. Collaborators: to be announced; 3:15–5 p.m.—Recent Developments in Cardiac Surgery. Panel Discussion. Moderator: WILLIS J. POTTS, Chicago. Collaborators: HENRY T. BAHNSON, Baltimore, CONRAD R. LAM, Detroit, C. WALTON LILLEHEI, Minneapolis.

UROLOGY

TUESDAY, 1:30–3 p.m.—Management of Undescended Testes. Panel Discussion. Moderator: NORRIS J.

HECKEL, Chicago. Collaborators: ROBERT J. PRENTISS, San Diego, JOHN N. ROBINSON, New York, LESLIE BRAINERD AREY, Chicago, ORMOND S. CULP, Rochester, Minn.

WEDNESDAY, 3:30–5 p.m.—Management of Prostatic Hypertrophy. Panel Discussion. Moderator: VICTOR F. MARSHALL, New York. Collaborators: JAMES M. CAMPBELL, Saskatoon, CHARLES D. CREEVY, Minneapolis, ROBERT LICH, JR., Louisville, Ky., SAMUEL A. VEST, Charlottesville.

THURSDAY, 1:30–3 p.m.—Management of Renal Lithiasis. Panel Discussion. Moderator: CHARLES C. HIGGINS, Cleveland. Collaborators: WILLARD E. GOODWIN, Los Angeles, EDWIN L. PRIEN, Brookline, EPHRAIM SHORR, New York, HARRY M. SPENCE, Dallas, WILLIAM L. VALK, Kansas City, Kan.

FRIDAY, 1:30–3 p.m.—Evaluation of Supra-radical Surgery in Malignant Disease of the Lower Abdomen and Pelvis. Panel Discussion. Moderator: EUGENE M. BRICKER, St. Louis, Mo. Collaborators: General Surgery, R. KENNEDY GILCHRIST, Chicago; Gynecology, JOE V. MEIGS, Boston; Urology, JOHN K. LATTIMER, New York; Radiology, JAMES J. NICKSON, New York.

Important Notice to Ophthalmologists and Otolaryngologists

The original announcement of the Clinical Congress stated that there would not be the usual three day sessions for these two specialties, but that one evening session would be held for each specialty. It has since been decided to omit this year all sessions for these two specialties, because the Academy meetings will be held in Chicago immediately preceding the Clinical Congress.

Postgraduate Courses

Postgraduate courses will be given Monday through Thursday mornings, with the exception of Obstetrics and Gynecology, which meets Monday through Friday. Admission is limited to ticket holders only, so advance registration is essential. The fee is $5.00.

Courses and Chairmen are:

Preoperative and Postoperative Care. HENRY N. HARKINS, Seattle

Gastrointestinal Tract. JOHN D. STEWART, Buffalo

Cardiovascular Surgery. C. WALTON LILLEHEI, Minneapolis

Hand Injuries. MICHAEL L. MASON, Chicago

Obstetric and Gynecologic Surgical Care. JOHN I. BREWER, Chicago

Malignant Bone Tumors. MURRAY M. COPELAND, Washington, D. C.

Surgical Aspects of Pulmonary Disease. HERBERT C. MAIER, New York

Forum on Fundamental Surgical Problems

There will be sixteen Surgical Forum sessions this year, with one or more in each of the five special fields of surgery. Sessions will be held mornings and afternoons, Monday through Friday. The complete list of reports will be published in the next issue of this Journal.

Color Television

Surgical procedures performed at Illinois Research and Educational Hospitals will be telecast to the Conrad Hilton, with almost all of the surgical specialties represented in the program. Making the program even more valuable this year is the addition of a panel of teachers, in addition to the surgeon whose work is being shown, to discuss the problems presented by the operation. A special brochure will be available outlining the program in detail.

Dr. J. Garrott Allen, the College's national chairman for television, and Dr. Warren H. Cole, head of the department of surgery, University of Illinois College of Medicine, are in charge of this program, assisted by Dr. John T. Reynolds who is in charge of the university's television work. Smith, Kline & French Laboratories are sponsors of the television program.

Ciné Clinic

Significant surgery throughout the United States will be featured in the popular Ciné Clinic program, sponsored by Davis & Geck, Inc. Special attention is called to the panel on cancer of the large intestine, with panelists Dr. Owen H. Wangensteen, Dr. Warren H. Cole, and Dr. Walter G. Maddock. A general outline of subjects and participants follows:

Hindquarter Amputation. BRADLEY L. COLEY, New York

Mediastinal Tumors. JOHN H. GIBBON, Philadelphia

Cardiac Surgery. WILLIS J. POTTS, Chicago

Cardiac Surgery. HENRY W. SCOTT, JR., Nashville

Radical Surgery for Oral Cancer. DANELY P. SLAUGHTER, Chicago

Surgery for Massive Ulcer of the Leg. CARL A. MOYER, St. Louis

Transthoracic Gastrectomy. RICHARD H. SWEET, Boston

Varicose Veins. GEZA DE TAKATS, Chicago

Surgery of the Thyroid. GEORGE W. CRILE, JR., Cleveland

A Phase of Plastic Surgery. JAMES BARRETT BROWN, St. Louis

Motion Pictures

The popular Motion Picture Symposium will be held on Wednesday evening, with the author present to narrate the film. Films will be shown mornings and afternoons. On Monday general surgery will be featured all day. The remainder of the week will feature specialties in the morning, and general surgery in the afternoon. Dr. Hilger Perry Jenkins, Chairman, the Committee on Medical Motion Pictures, and special consultants, have chosen for this Congress the finest program ever presented at this annual meeting.

Special Guest Speakers

Dr. Grayson L. Kirk, President of Columbia University, will give the Martin Memorial Address on the opening evening session. On Thursday afternoon Dr. Frank B. Berry, Assistant Secretary of Defense, Health and Medicine, will give the Trauma Oration, on the topic "Mass Casualties." On the final Convocation evening Dr. Warren H. Cole, incoming President, will speak on "Surgical Philosophy Old and New."

Special Symposia

TRAUMA

TUESDAY, 2–5 p.m.—R. ARNOLD GRISWOLD, Louisville, Presiding. Symposium on Automobile Accidents: JOHN O. MOORE, Cornell University, New York, C. HUNTER SHELDEN, Pasadena, ROSS MCFARLAND, Boston.

Traumatic Injuries to the Liver: JOHN M. HOWARD Houston, MICHAEL E. DEBAKEY, Houston, WALTER E. MIKESKY, Houston.

Roadside Accidents: GEORGE J. CURRY, Flint, Mich.

Transportation of the Injured Within the Hospital: DAVID R. LIMBACH, Flint.

CANCER

WEDNESDAY, 2–5 p.m.—DANELY P. SLAUGHTER, Chicago, Presiding.

A Choice of Treatment in Breast Cancer. SIR STANFORD CADE, London.

Papillary Thyroid Carcinoma. EDGAR L. FRAZELL, New York City.

Surgical Implications of Radiotherapy. HOWARD HUNT, Omaha.

Tumor Cell Contamination in Cancer Surgery. LAUREN V. ACKERMAN, St. Louis.

Malignant Tumors of the Endometrium. HERBERT E. SCHMITZ, Chicago.

GRADUATE TRAINING IN SURGERY AND THE SURGICAL SPECIALITIES

THURSDAY, 1:30–3 p.m.—FREDERICK A. COLLER, Presiding.

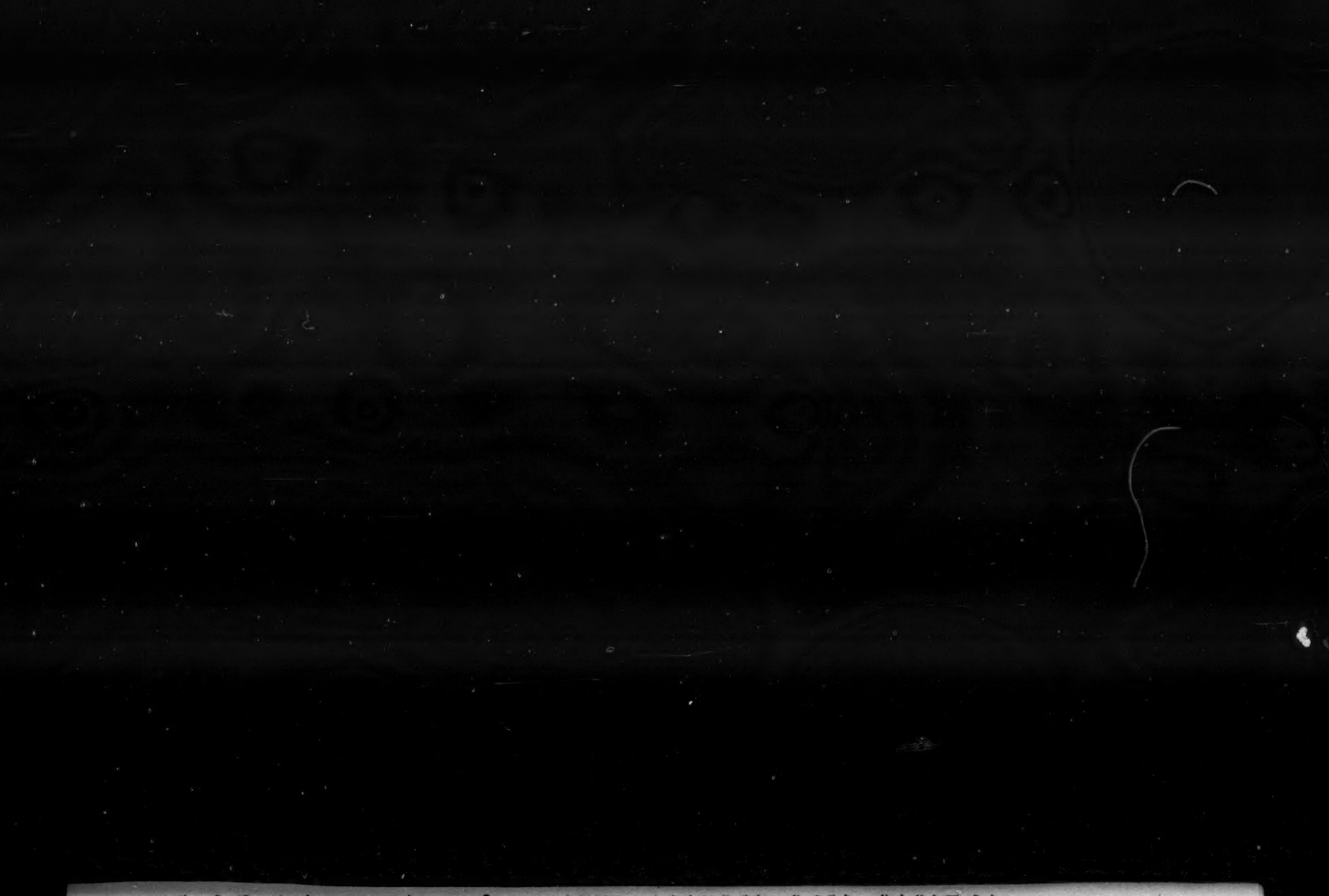
MOTION PICTURE SYMPOSIUM

WEDNESDAY, 8:30 p.m.—Name of presiding officer to be announced.

Advance Reservations

All official registration forms—advance registration, postgraduate courses, transportation, and hotel accommodations—must be obtained from The American College of Surgeons, 40 East Erie Street, Chicago 11, Illinois.

The advantages of earlier registration are twofold: you are handed your badge and tickets immediately on checking in at the advance registration desk, so that there is no waiting in line; regarding postgraduate courses you are more likely to obtain admittance to the course which you have indicated as your first choice, and your ticket will be sent to you before you arrive.

For the convenience of Congress visitors the official registration desks will be open Sunday, October 30, from 3 to 7:30 p.m., Monday from 8 a.m. to 6 p.m. and Tuesday through Friday from 8 to 5 p.m.

Fees, except for the postgraduate courses, are not required of Initiates, endorsed Junior Candidates, or Surgical Residents. Fellows whose dues are paid to December 31, 1954, do not pay a registration fee; those whose dues are not paid are charged $20.00. Non-Fellows pay $20.00, and members of the Federal Services pay $10.00. Postgraduate course fee is $5.00.